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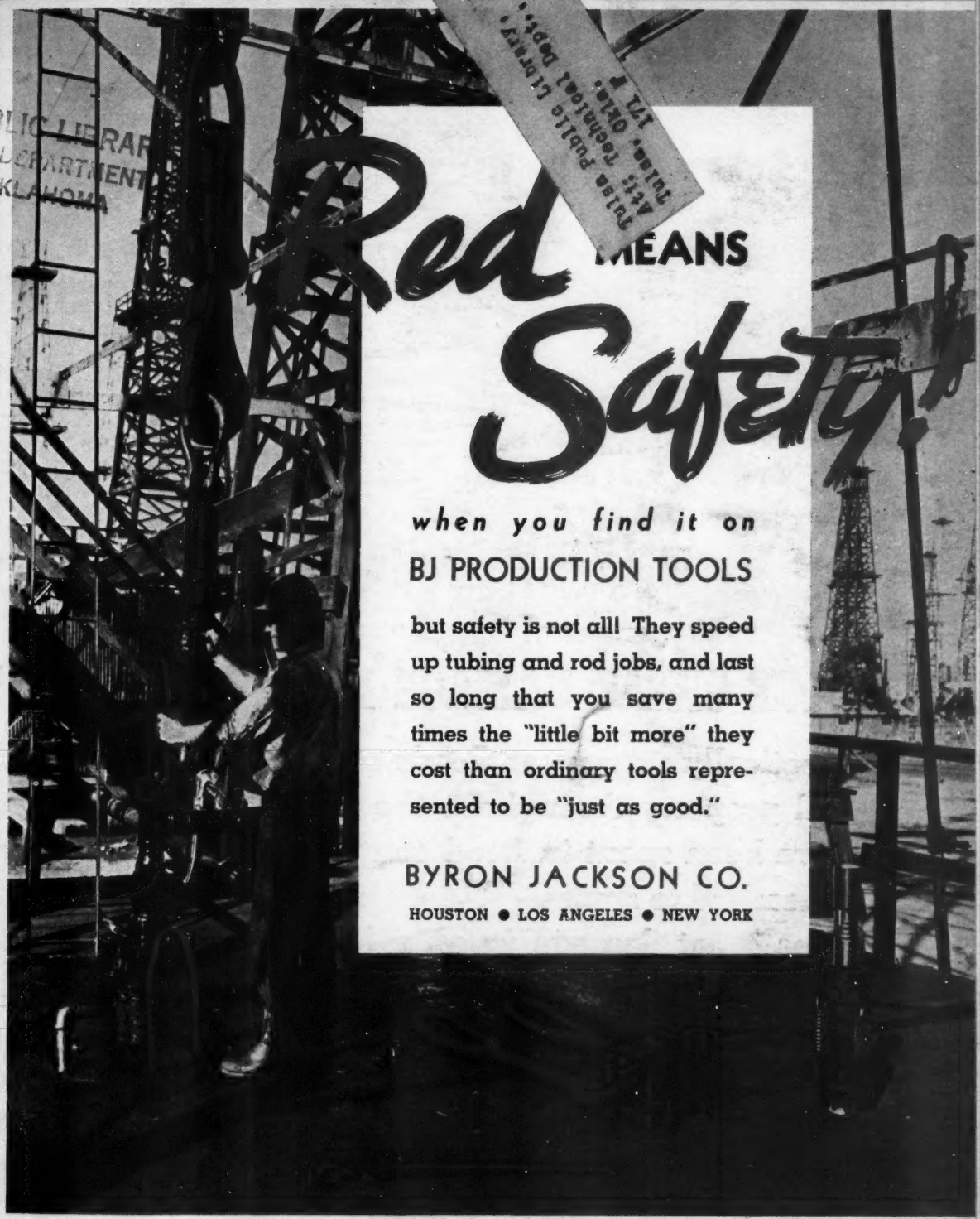

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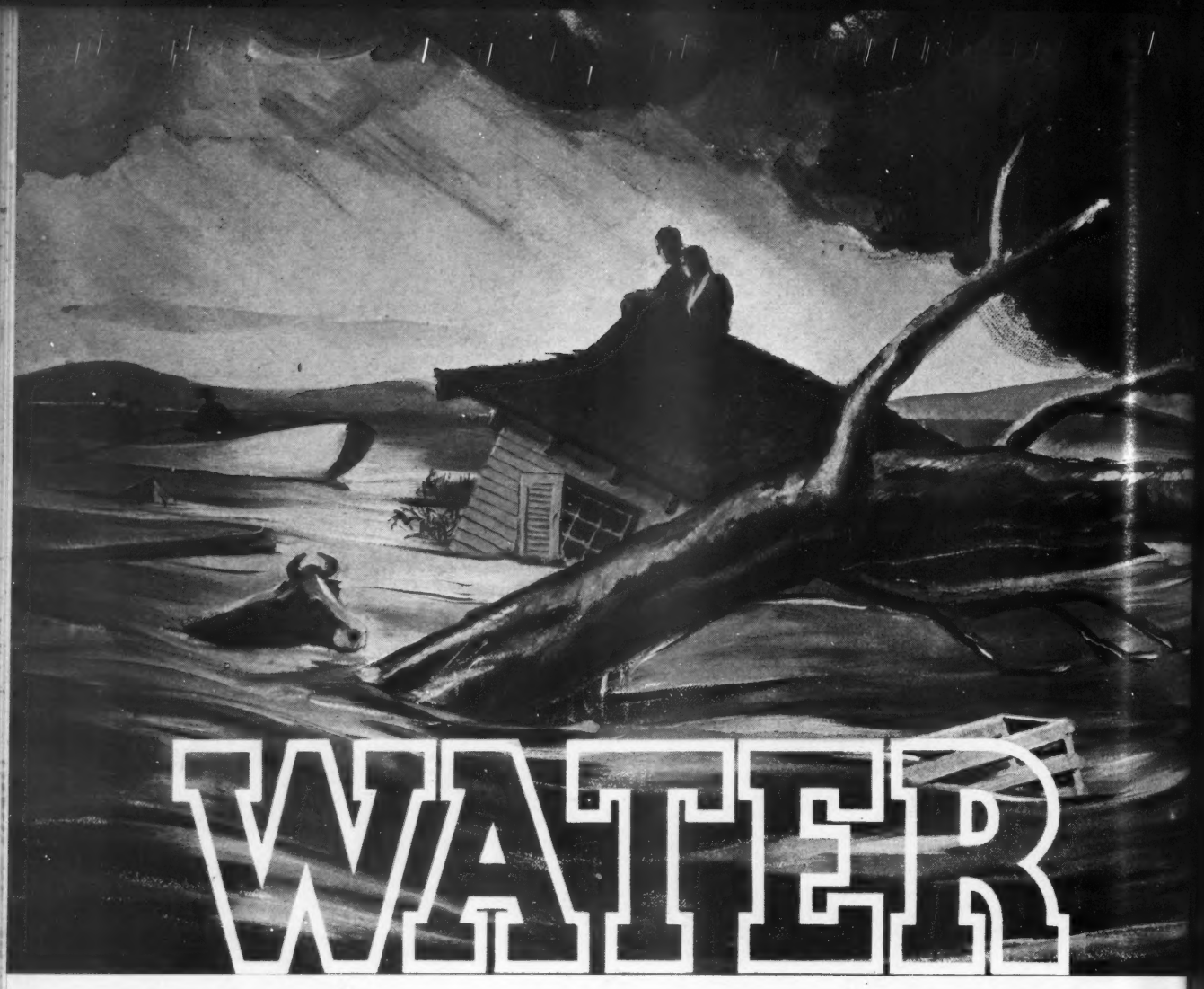

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THE AUTHORITY ON THE CALIFORNIA OIL INDUSTRY

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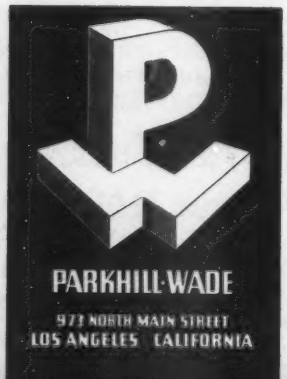

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A Future Review of Past Developments

of Natural Gasoline Motor Fuel

By C. C. Moore
Union Oil Co. of California

I have been asked to discuss the role of natural gasoline in fuels of the future. This assignment is, of course, very easy, as it is difficult to prove that one is technically cockeyed when your predictions are based far enough in the future. Instead of taking the easy way out, however, and talking only of the future, I would like to review fuels and engines of the past, going back from the present year of 2000 A. D.

Sixty years ago, or back in 1940 when our grandfathers were just old enough to vote on "Ham and Eggs," the so-called automobiles had from six to eight cylinders, had cylinders as big as 3.5 inches in diameter, and had a fuel system that included a pump and a so-called "carburetor." There is, incidentally, in the National Museum a specimen of one of these carburetors, and from the available records its function was to mix what was then called gasoline with air, and then by means of a very crude cast iron fitting the whole mixture was sucked into the engine's cylinder and in due course fired by a spark plug. The records indicate that this spark plug was some kind of a gadget sold to the long-suffering motorist by the service stations, and there is evidence that such sales were usually preceded by certain references to "Plugs need cleaning, too," or similar unintelligible statements. The fuel that was used in these 1940 automobiles was very different from our present day fuels. It contained only about 20 to 30% of natural gasoline that had been stabilized to about 22 lb. vapor pressure, and the balance was made up of straight-run and cracked gasoline fractions. The finished fuel had a distillation range of from about 100° to 400°F. and a vapor

Presented before C. N. G. A. Annual Fall Meeting, Ambassador Hotel, November 17, 1939.

Here is the committee responsible for the highly successful all-day meeting of the California Natural Gasoline Association in Los Angeles, Nov. 17. Left to right: W. C. Dayhuff, Standard Oil Co., chairman; John H. Kunkel, Kunkel Advertising Agency; Harry Fiske, Ingersoll-Rand; Coles Bason, Ingersoll-Rand; Doug. Balthis, Natural Gas Equipment Co.; P. S. Magruder, General Petroleum Corp., association president; Clare Gard, Union Oil Company, and G. L. Tyler, association secretary.

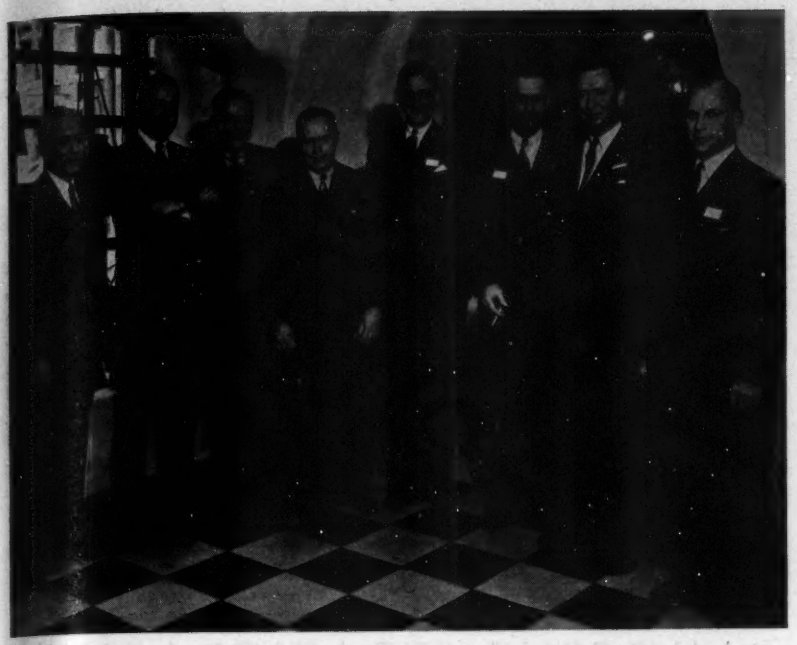
pressure of only 10 lb./sq. in. The primary reason for such a low vapor pressure was, of course, the difficulties experienced with the fuel pump and carburetor, since anything like the present day 2000 A.D. fuel would vaporize to such an extent that the pump could not handle it.

Before we leave the 1940 grandfather of the present day car it is interesting to review the engine characteristics. As mentioned earlier the typical cylinder bore was about 3 inches, and the compression ratio was about 6 to 1. At the maximum engine speeds of 3000 to 4000 r.p.m., the b.m.e.p. was only 100 lb./sq. in., with a brake horse power of about 100 to 110 for a 250 cubic inch displacement motor. The average fuel used had an octane number of as low as 70, and even the highest antiknock grade was only about 82 octane number. When compared to our present third grade gasoline of 100 octane number you can readily understand some of the difficulties the early 1940 cars labored under.

As I remember it, in 1950 Henry finally gave in and produced his cars with the then common supercharger system, and this can be considered as the beginning of the modern car era. Prior to 1950, superchargers were regarded as only necessary on the better grade passenger cars, but the bus and truck engine manufacturers were by then completely standardized on superchargers. The change in the average passenger car

Speakers at C.N.G.A. All-Day Meeting Nov. 17, left to right: Roy M. Bauer, Southern Calif. Gas Co., "Conservation and Utilization of Natural Gas in California"; John S. Gallagher, The Texas Co., "C.N.G.A. Liquefied Gas Standards"; Dr. K. Korpi, Union Oil Co., co-author, "Alkylation"; C. C. Moore, Union Oil Co., "Role of Natural Gasoline in Motor Fuels of the Future"; Dr. W. J. Podbielniak, Consulting Engineer, "Advances in Analytical Fractionation Technique" and "The Super-Contactor"; A. L. Blount, Union Oil Co., co-author, "Alkylation."

Directors, Officers, Committee Chairmen and Speaker's Luncheon in the Modern Room of the Ambassador Hotel, where C.N.G.A. held its All-Day meeting Nov. 17.



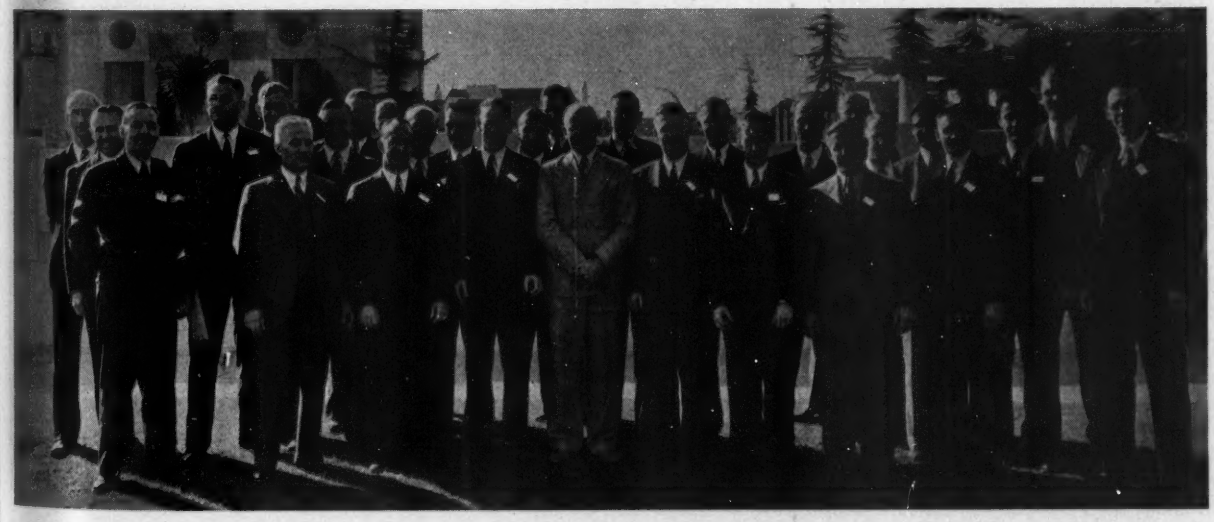
Past Presidents of the California Natural Gasoline Association at the 1939 All-Day meeting, left to right: R. E. Beckley, Standard Oil Co. (San Francisco); O. C. Field, O. C. Field Gasoline Corp.; R. C. Wheeler, General Petroleum Corp.; H. L. Eggleston, Gilmore Oil Co.; Tom Taggart, Standard Oil Co.; R. D. Gibbs, Union Oil Co.; J. C. Burks, O. C. Field Gasoline Corp., and H. R. Linhoff, Richfield Oil Co.

engine between 1940 and 1950 was quite marked. Instead of 3-inch diameter cylinders the largest produced was only 2 inches in diameter, and the typical engine speed had been increased to about 9000 r.p.m. Typical supercharger pressures were 50 to 100 lb./sq. in., and under full throttle conditions, a b.m.e.p. of around 300 lb./sq. in was obtained. These engines, incidentally, gave about ten times the output per cubic inch that the prehistoric Model T gave. These early advances in engine design were made possible by the development of beryllium-nickel valve springs, sodium cooled valves, and a better understanding of vibration control.

The general use of superchargers after 1950 made possible the elimination of the very complicated carburetor and inlet manifold, and of course the fuel pump no longer was necessary with the fuels then in use. Instead of stabilizing natural gasoline to 20 to 25 lb. vapor pressure and thus automatically removing from it the valuable high octane number fractions, the typical natural gasoline had a vapor pressure of about 60 lb./sq. in. and the refiner used from 30 to 40% in his blends. The finished fuel in 1950 had the usual 400°F. end point, but of course was very volatile in the first part of the distillation range, and had a vapor pressure of around 30 lb./sq. in. at 100°F., or slightly higher than the early 1940 natural gasoline by itself. It was, of course, necessary to handle the 1950 fuels under pressure, and this was the final death blow to the early engine designers who thought that a fuel pump, with all its attendant griefs, was a necessary part of an engine. The early 1950 to 1960 cars abandoned the conventional carburetor, but they still retained somewhat of the old designs inasmuch as they had mechanical injection of the fuel into what might be called the last remaining traces of the inlet manifold. Here the fuel in its finely atomized state was picked up by the entering air from the supercharger, and the mixture forced into the cylinders under 50 to 100 lb. pressure. The old troubles of mixture distribution were, of course, thus greatly reduced, and there was no need for seasonal gasolines of differing volatilities.

Cold starting troubles were, in 1960, something that you read about as having once occurred, but in 1960 only the fourth grade gasolines of around 20 pounds vapor pressure ever gave any of this type of trouble.

As we go back through the records we find that in 1965 the invention of the alloy "diamoline" really made possible the development of the present day type of automotive engine. This alloy, before heat and chemical treatment, could be micro-finished to an unbelievably fine surface, and yet after the hardening



Standard Oil Co. is always well represented at the California Natural Gasoline Association Educational Sessions. Here is their contribution to attendance at the all-day meeting.

treatment it would easily mark a diamond, the previously accepted "hardest" material. With this alloy available, there were no further difficulties in the mass production of solid injection fuel distributing systems, and the closely fitted plungers would not seize or score the injector barrels even when run dry, while with gasoline as a lubricant, their service life was indefinite. The change from the old hit-or-miss carburetor to inlet manifold injection and then to individual cylinder solid injection took almost thirty years, but this time lag was due to the necessity of adjusting the fuels and the mechanical developments to each other.

The individual cylinder solid injection of fuel meant that a precise amount of fuel could be metered to each and every cylinder, and with a controlled supercharger pressure the exact fuel-air ratio desired could be maintained under all conditions of speed and load. This in turn meant that high antiknock value fractions were at a premium, since by 1980 the best motors had maximum brake mean effective pressures of 400 to 500 lb./sq. in and would practically disintegrate from detonation with any fuel of less than 100 octane number. In the early preinjection days the gasoline refiner went to considerable expense to remove the propane and isobutane from his natural gasoline before blending it in gasoline. Today this seems almost incomprehensible, since from 1990 to the present year 2000 these formerly "waste products," propane and isobutane, are almost the only naturally occurring hydrocarbons that are now used in our automotive fuel. Their antiknock value is, of course, relatively low, as propane has an octane value of only 125, while isobutane is as low as 100 octane number. These natural hydrocarbons, however, can be blended with the modern chemically formed compact molecular structure fuels, and when the recently developed zeta-ray cracked fuels are included in the blend a very satisfactory 150 octane number base fuel is obtained. The addition of any of the modern antiknock dopes, such as Gibbsolvent, Taggartarium, or Dayhuffmanite, will of course bring the fuel up to our present antiknock standards.

In all justice to the early engine designers, it must be remembered that they did not have available many of our now commonly accepted automotive accessories. For example, to ignite the charge in the combustion chamber, they had to rely on a spark plug, and this crude device was the source of a great deal of trouble. If it did not operate at a high enough temperature it fouled with carbon and at a compression pressure of as low as 100 lb./sq. in. it would short circuit. On the other hand, if its operating temperature was high enough to prevent fouling, it formed a local hot spot, and this upset the combustion process by causing uneven rates of burn within the cylinder, which of course gave rise to detonation. With our present day ignition system by means of which the whole charge is ignited uniformly by atomic disintegration it is hard to visualize the early difficulties, but it was not until about 1985 that atomic disintegration could be depended upon. With the final perfection of the modern electro-disintegrator, the engine designer is not confronted with the combustion pressure waves that in the early days caused flame front compression pressures of a thousand or more pounds per square inch, with the consequent necessity for heavily built engines that weighed as much as two pounds per horsepower developed. Our modern 2000 A.D. engines that weigh from a quarter to a half pound per horsepower would seem almost like a toy beside the giant-sized but relatively low-powered motors of 1940.

In closing this very brief review of the interlocked history of the mechanical development of the automotive engine and the fuels that permitted this development, I wish to give credit to Buck Rogers, who helped me in the historical research. I would also like to sound a word of warning. It is rumored that next year's new 2001 models will require a higher antiknock fuel than is now commonly available. I believe that the petroleum industry should avoid any leanings toward an octane war.

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Natural Gas Conservation and Utilization

(California) Studied From 1906 to Present

By Roy M. Bauer[1]

During the early stages of development of the oil industry in California, the primary interest being production of crude oil, the gas was disposed of in the simplest manner and without regard to the future. In fact, natural gas was considered a prime nuisance. The problem of conservation and utilization of California's natural gas production has been continuously before the field operator, absorption plant superintendent, and the gas company executive since the inception of large volume production, about 1910. A historical picture of gas production and supply[2] was recently presented by the author before the Pacific Coast Gas Association and will only be covered briefly here.

Natural gas is a very old commodity, as shown by the account of the ancient Greek oracle at Delphi. In the United States, although gas was reported as early as 1775 in the Ohio Valley, it was not until 1870 that a well producing gas and oil was completed in California, near Newhall. About 1903 large oil production was developed in the Coalinga and Kern River fields, but it was in 1909 that the large volume high-pressure wells developed in Buena Vista Hills, Kern County, focused attention on natural gas.

Presented before C. N. G. A. Annual Fall Meeting, Ambassador Hotel, November 17, 1939.

In order to study the highs and lows in the production and utilization picture, Table No. 1 was prepared for the years 1906 to date. All data for 1930 and subsequent years was obtained from the publications of the State Department of Natural Resources, Division of Oil and Gas. The net production from 1921 to 1929, inclusive, is largely a compilation from records of Southern California Gas Company and one of its affiliated companies, Midway Gas Company. Prior to 1921 the net casinghead production from formation is largely a calculation based on a gas to oil factor. The total net production to date of 6,845,743,396 M. cubic feet is composed of 6,594,412,256 M. cubic feet casinghead gas and 251,331,140 M. cubic feet dry gas, which indicates that most of the natural gas that the industry receives is produced along with crude oil, and the association of the two is so close that we cannot consider them separately. Utilization figures prior to 1930 were obtained from yearly summaries issued by the U. S. Bureau of Mines. Gas stored from 1927 to 1929, inclusive, is from gas company compilation. Unconserved gas is a calculated figure.

The prolific production of gas with the resultant tremendous wastages of this natural product, especially during the two eras of highly competitive townlot development in the Los Angeles Basin area, 1922-24, and 1928-30, stressed the need for gas conservation in this State.

It will be noted the unconserved gas

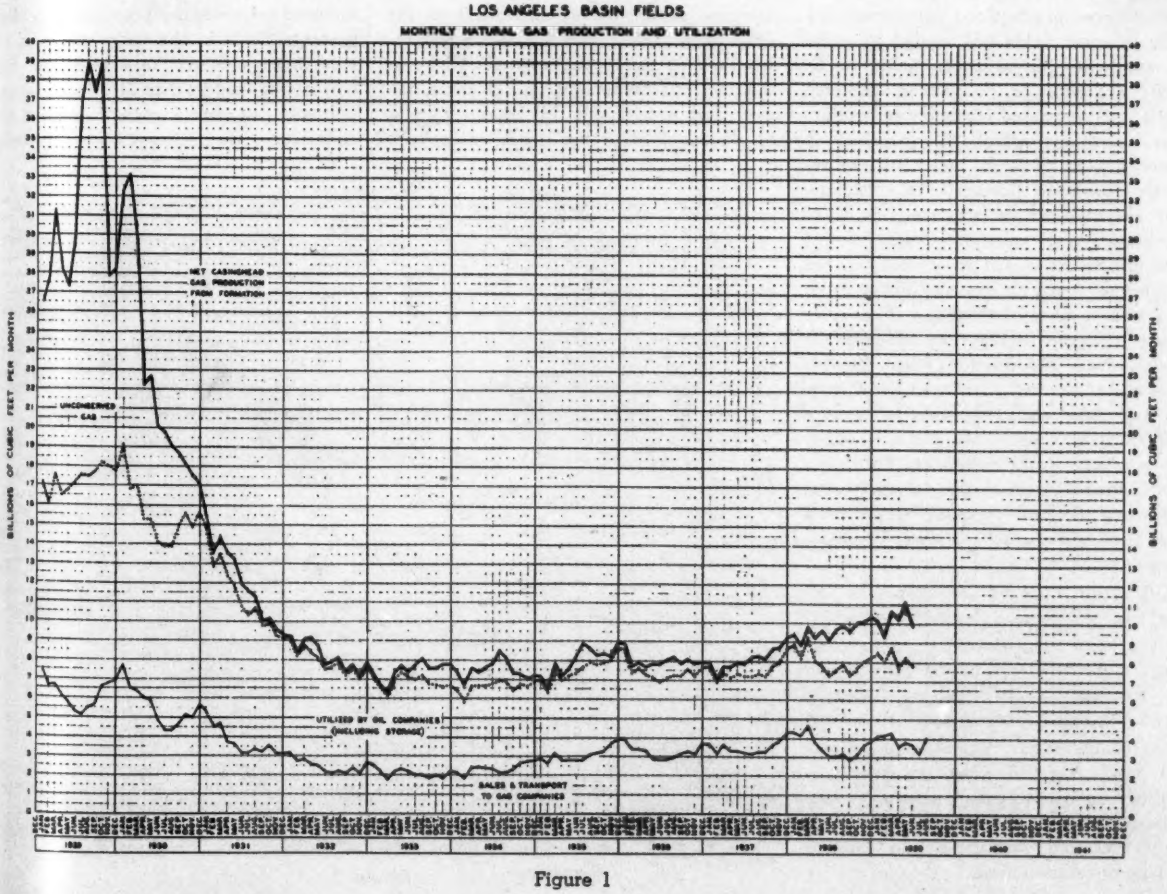
LOS ANGELES BASIN FIELDS
MONTHLY NATURAL GAS PRODUCTION AND UTILIZATION
BILLIONS OF CUBIC FEET PER MONTH
NET CASINGHEAD GAS PRODUCTION FROM FORMATION
UNCONSERVED GAS
UTILIZED BY OIL COMPANIES (INCLUDING STORAGE)
SALES & TRANSPORT TO GAS COMPANIES

Figure 1

TABLE NO. 1
State of California
NATURAL GAS PRODUCTION AND DISPOSITION

YEAR	NET PRODUCED(a)	UTILIZED	STORED	UNCONSERVED Amount	UNCONSERVED Percent
Prior	65,314,000	?	.....	?	....
1906	20,465,000	153,000	.....	20,312,000	99.3
1907	28,570,000	230,000	.....	28,340,000	99.2
1908	33,920,000	479,000	.....	33,441,000	98.6
1909	40,595,000	2,324,000	.....	38,271,000	94.3
1910	64,960,200	2,764,000	.....	62,196,200	95.7
1911	73,492,389	6,390,000	.....	67,102,389	91.3
1912	76,376,581	9,355,000	.....	67,021,581	87.8
1913	86,812,485	11,035,000	.....	75,777,485	87.3
1914	96,446,996	17,829,000	.....	78,617,996	81.5
1915	78,962,847	21,891,000	.....	57,071,847	72.3
1916	80,105,684	31,643,000	.....	48,462,684	60.5
1917	93,329,401	49,427,000	.....	43,902,401	47.0
1918	102,678,908	39,719,000	.....	62,959,908	61.3
1919	116,296,253	55,607,000	.....	60,689,253	52.2
1920	118,691,444	66,041,000	.....	52,650,444	44.4
1921	128,363,472	75,942,000	.....	52,421,472	40.8
1922	158,689,830	84,580,000	.....	74,109,830	22.2
1923	333,365,730	131,434,000	.....	201,931,730	73.5
1924	274,558,185	189,692,000	.....	84,866,185	37.9
1925	224,075,135	187,789,000	.....	36,286,135	16.2
1926	229,192,113	204,915,000	.....	24,277,113	10.6
1927	265,883,099	212,364,000	533,000	52,986,099	19.9
1928	313,455,872	246,215,000	5,037,929	62,202,943	19.8
1929	563,544,807	342,214,000	13,317,160	208,013,647	36.9
1930	554,116,901	307,722,401	14,427,490	231,967,010	41.9
1931	387,259,813	301,574,388	11,088,871	74,596,554	19.3
1932	282,076,101	250,244,442	11,769,332	20,062,327	7.1
1933	272,466,878	252,642,323	5,363,972	14,460,583	5.3
1934	288,099,304	268,236,197	1,288,197	18,574,910	6.5
1935	319,115,132	294,154,699	1,890,764	23,069,669	7.2
1936	343,864,295	319,403,271	b	24,461,024	7.1
1937	354,764,052	335,800,628	b	18,963,424	5.3
1938	375,835,489	337,601,673	b	38,233,816	10.2

Al figures in Mcf.
a—Net casinghead gas from formation plus dry gas.
b—Included under utilized.

has been greatly reduced since 1931, Table No. 1 and Figure No. 1, Los Angeles Basin fields data. Several favorable,contributing factors assisted in this change; (a) there has been cooperation among producers in the prorating and curtailing of production; (b) natural decline in some fields has tended to cause all available gas in these fields to be used; (c) storage of gas in depleted sands; (d) increased efficiency in production operations which has resulted in lower gas-oil ratio in many of the recently developed fields; (e) the passage and enforcement of a State Gas Conservation Act; and (f) extensions of pipe line facilities and an increase in the number of natural gas customers from 1,250,000 to over 1,650,000. The composite of these factors has reduced the unconserved gas in this State to less than 8% at present. Statistics for Figure No. 1 for 1930 and subsequent years were from the Division of Oil and Gas publications, and from Southern California Gas Company records, and for 1929 from California Natural Gasoline Association and Southern California Gas Company records.

Utilization may be segregated as follows: (a) oil company requirements; (b) underground storage; and (c) gas company requirements. The different phases of each of these will be discussed separately in the paragraphs following.

Oil company gas requirements include gas used for following purposes; recycling, repressuring and pressure maintenance, lease and drilling fuel, gasoline plant fuel and shrinkage, and refinery and pump station fuel.

Recycling, or gas circulation, is a process which makes possible the recovery of hydrocarbon liquids that other wise may be lost through condensation in the reservoir during depletion of the reservoir pressure. It comprises the production, expansion, separation from the condensed liquids, recompression and return of the gas to the reservoir. Due to the fact that recycling gas is circulated over and over again this quantity must be deducted from the gross casinghead gas in arriving at the net formation production. The losses or use of gas in these operations fall largely under the heading of gasoline plant shrinkage and compressor fuel. No separate figures are available to indicate the usage of fuel gas for recycling. From a survey of the operations in the many California fields it is quite apparent that recycling is again on the increase after having reached a previous peak in December, 1931. For the years 1937 and 1938 the gas recycled was 14.7% of the gross casinghead production.

Repressuring and pressure maintenance were defined by Mr. A. C. Rubel[3] in his discussion at your fall meeting last year. These processes involve returning of high-pressure gas to the formation, either maintaining or building up the reservoir energy in order to obtain a greater ultimate recovery of oil.[4] In this operation gas is used as compressor fuel, and, in addition, a part of the gas used for repressuring may be stored on a temporary or on a semi-permanent basis in the oil zones. The use of gas for this purpose has varied from time to time, being as high as 45 million cubic feet daily the latter part of 1928, as compared to 11 million cubic feet daily in August, 1939.

Lease and drilling fuel, and gasoline plant fuel and shrinkage are the largest items of oil company requirements. High pressure fields in the early stages of development produce relatively low content casinghead gas, as Mr. H. P. George pointed out in a paper[5] before the American Gas Association recently,

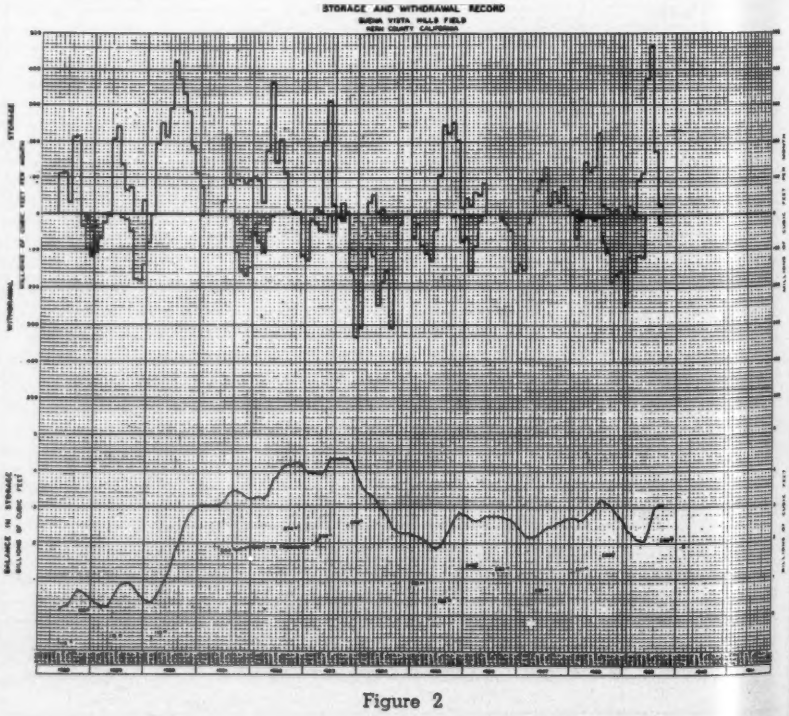

Figure 2

whereas a field with low formation pressures and settled production produces a higher content gas over a long period of time. Therefore the percentage of gas used for gasoline plant fuel and shrinkage will be much greater during the period of low net formation production and high gasoline content gas. For example, the peak of gas production in Santa Fe Springs field, and the highest monthly production of any field in the State, to date, occurred during the second era of development in February, 1930. During that month, 6.2% of the net production was used for plant fuel and shrinkage incident to casinghead gasoline recovery operations. About ten years later, in July, 1939, the net production had dropped to 3% of the peak month production with an increase in the plant fuel and shrinkage percentage to 50.1. Likewise the percentage of lease fuel and drilling fuel required in a field will be greater towards the end of the life of the field. Using Santa Fe Springs again, in February, 1930 the gas used for field fuel totalled 6.2% of the net production, while in July, 1939 the same item was 24% of the net production.

Refinery and pump station fuel may vary greatly, due to curtailment in gas and oil production or on account of economic conditions, or both. A peak for this class of usage was reached in 1937, but due to both of these factors mentioned, the year 1939 will show a marked reduction in the volume used.

TABLE NO. 2
State of California
INDUSTRIAL NATURAL GAS UTILIZATION(b)

YEAR	FIELD FUEL(a)	PETROLEUM REFINERIES	ELECTRIC GENERATION	OTHER
1927	121,393,000	17,831,000	7,140,000	30,691,000
1928	149,307,000	17,403,000	12,849,000	28,954,000
1929	216,337,000	17,205,000	26,914,000	38,259,000
1930	210,794,000	23,322,000	26,173,000	26,981,000
1931	150,331,000	18,234,000	45,907,000	36,729,000
1932	130,353,000	16,610,000	14,209,000	41,336,000
1933	113,107,000	17,519,000	15,682,000	48,738,000
1934	109,218,000	22,632,000	27,389,000	50,265,000
1935	110,050,000	25,010,000	18,041,000	61,949,000
1936	136,808,000	31,269,000	20,840,000	62,231,000
1937	140,743,000	32,619,000	15,554,000	59,144,000

All figures in Mcf.
(a) Drilling, pumping and operating gasoline recovery plants.
(b) From U. S. Bureau of Mines yearly summaries.

During the past three years in California the field fuel, drilling fuel, and plant fuel and shrinkage have consumed about 54% of the total State industrial natural gas utilization, and, in addition, petroleum refinery fuel has accounted for about 12½%. In order to give a comparison with other types of industrial utilization, Table No. 2 showing oil and gasoline company field fuel, petroleum refinery fuel, steam electric generating fuel, and other industrial fuel, has been prepared. All figures were taken from the U. S. Bureau of Mines yearly summaries.

Underground gas storage is a process of pumping gas into an underground reservoir under conditions such that the major portion of the gas may be recovered when needed at some future time. Since 1926, in California, the majority of such projects have been confined to the injection of gas into depleted dry gas zones. As Mr. Rubel stated last year, the outstanding project in this State has been in the Buena Vista Hills field, Kern County. Our records indicate for limited periods of time injection pressures of as high as 320 pounds per square inch have been used, with injection rates as high as 25,000 Mcf. per day. Withdrawals of approximately 18,000 Mcf. daily have been recorded. Figure No. 2 has been prepared

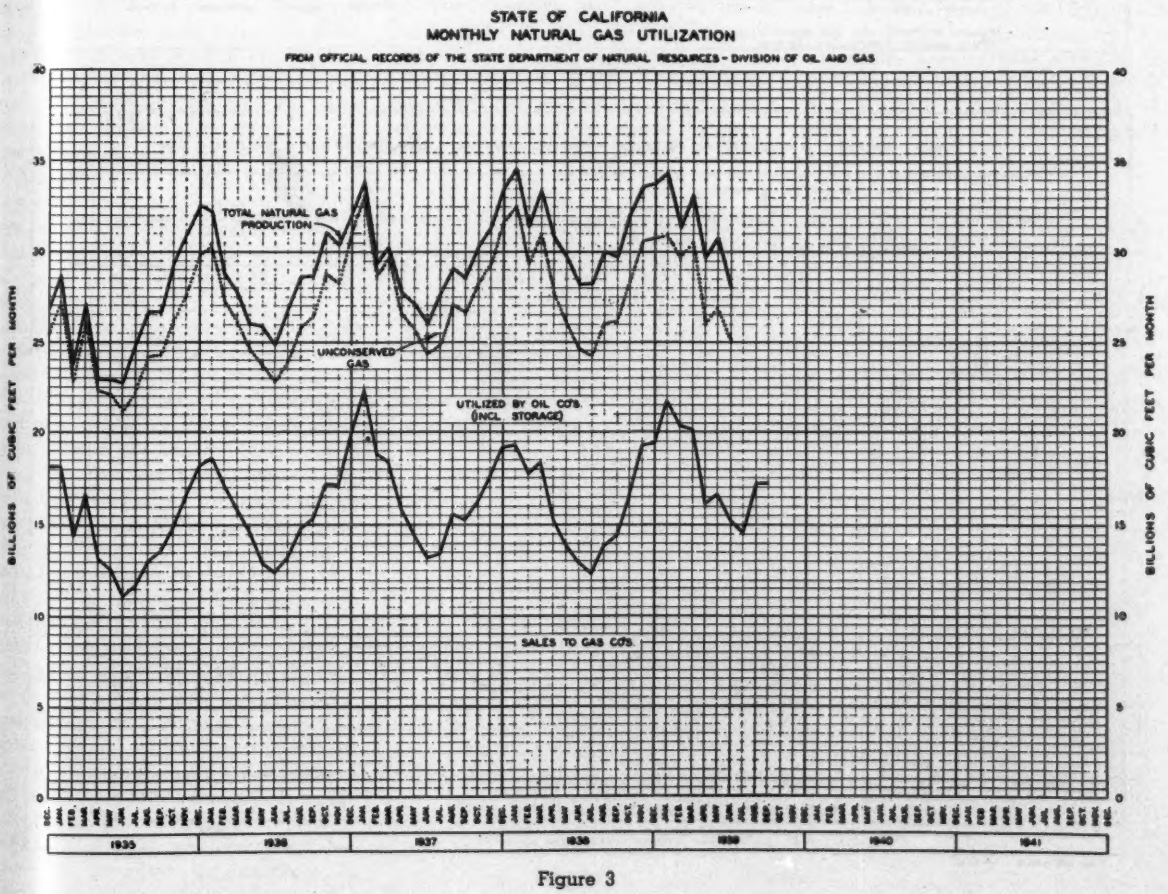

Figure 3

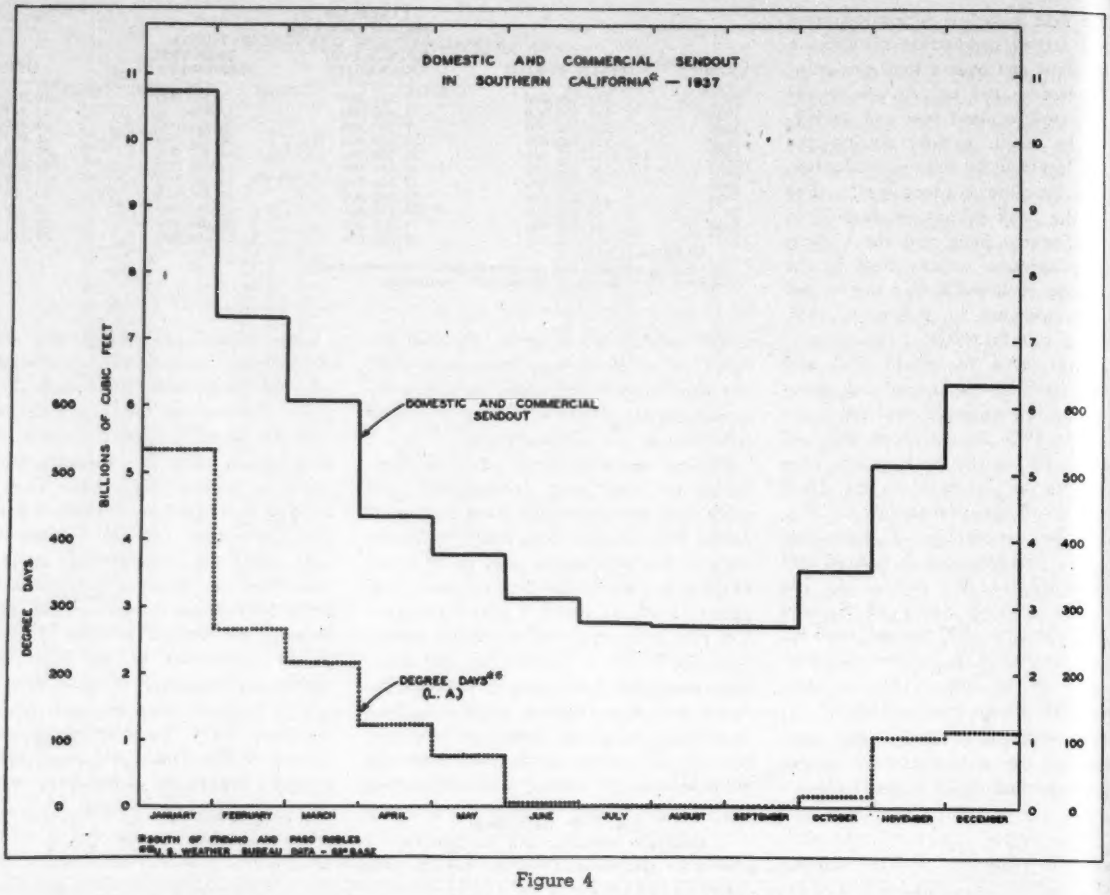

Figure 4

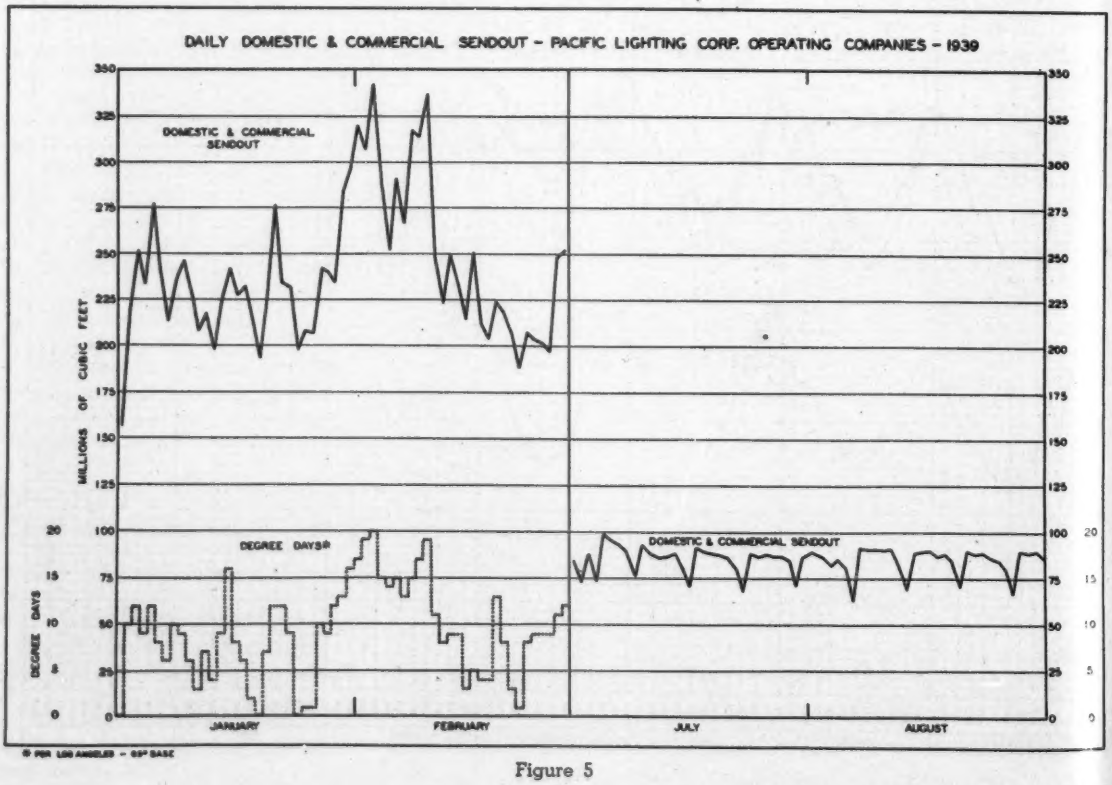

Figure 5

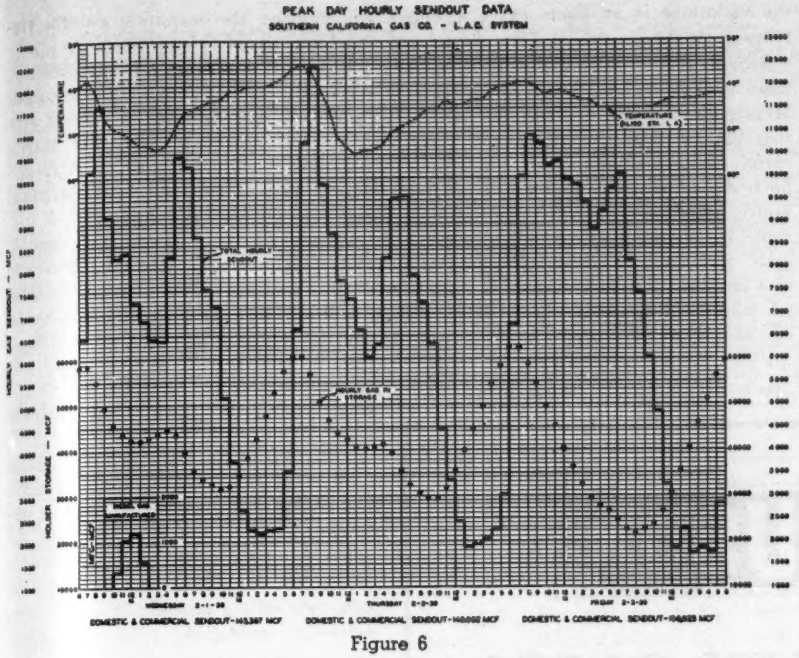

Figure 6

to show the monthly injections and withdrawals. The pressures shown underneath the "balance in storage" curve in the last few years were taken, at times, during periods when injection or withdrawal was almost a continuous operation. For this reason the formation pressures may not have been in equilibrium, and this has been so designated on the chart. This project has been so satisfactory that the use of the reservoir for seasonal storage and withdrawal will be continued.

Attempts were made, prior to 1939, to store gas in four other areas. Only one of these had any measure of success, and the recovery from it at the present time is very slow.

Mr. Rubel also mentioned the combination storage and repressuring project in the Dominguez field carried out in 1927. His conclusions were that such a program could be carried on with satisfaction and be of value to the operator, lessor, and the gas companies. It is hoped that a similar project may be again undertaken in the not far distant future in this locality, as Dominguez is one of the few fields in the Los Angeles Basin that is controlled by a relatively small number of operators.[6]

Gas storage in depleted dry gas fields whose sands are free from water infiltration is highly desirable, both from a standpoint of gas conservation and to provide a volume which can be fluctuated through wide limits to assist in taking care of the variable customer demands during the winter season.

Although natural gas was used for commercial purposes in California as early as 1894, and the Santa Maria Gas Company commenced the service of natural gas to its customers in 1907, it was the completion of the Midway Gas Company's 12¾" line from Buena Vista Hills to Glendale and Los Angeles in April, 1913 that really started large volume utilization in this State.

As new sources of supply were tapped additional communities and areas were served with natural gas, and by February, 1927 all the communities in the Los Angeles Basin District were enjoying straight natural gas service.

It was the development of the great Kettleman Hills gas and oil field that enabled the Pacific Gas and Electric Company to distribute natural gas in the San Francisco Bay Region in August, 1929.

Since that time transmission facilities have been extended to the City of San Diego and to Sacramento Valley communities, and today practically every important community in the State has natural gas service.

From the small beginning in 1907 the expansion in markets was so rapid that by 1932, twenty-five years later, California stood first in natural gas sales and first in natural gas customers among the states of the Union. Since that time the State has continued at the top of the list in the number of customers, but in 1936 Texas reached first place in sales and California has maintained a close second ever since.

The monthly requirements of the California gas companies from January, 1935 to date, are shown in Figure No. 3. Net production and unconserved data are from official publications of the Division of Oil and Gas. Gas purchases are from gas company records.

At certain periods during the year, principally from November to April, California weather may undergo rapid and unusual changes which affect utilization of gas.[7] Many hundreds of thousands of customers use natural gas as a

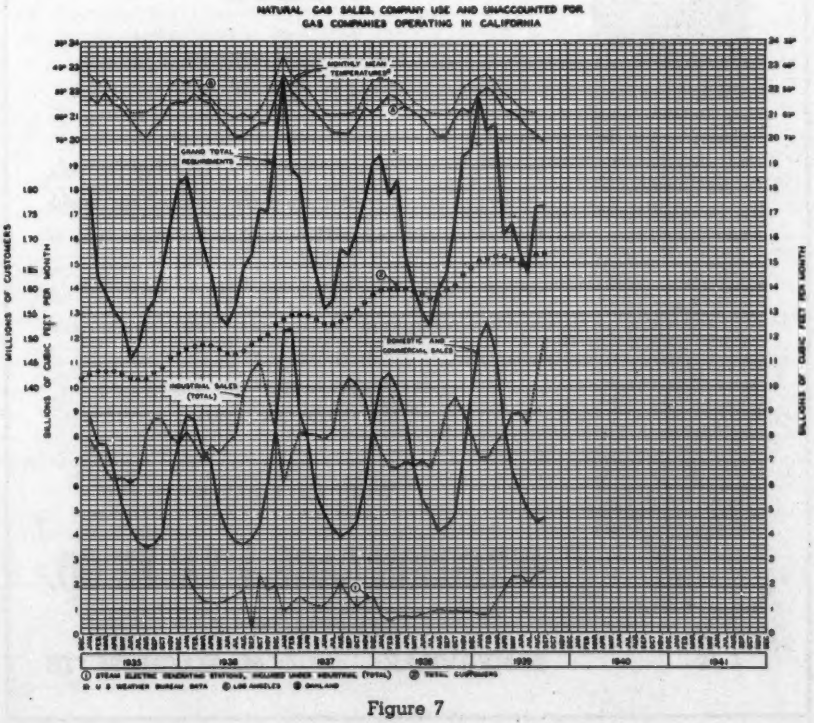

Figure 7

convenient source of heat, and when mean temperatures become lower and inclement weather sets in during the winter months variable increases in essential gas demands occur. This is shown graphically in Figure No. 4 for 1937; the early part of that year was the coldest continuous period on record for the Southern California district.

A comparison of the essential domestic and commercial daily requirements between winter and summer days is shown in Figure No. 5. Although the winter of 1938-39 was not a severe one from a weather standpoint, nevertheless the variations in sendouts cover a wide range.

February first, second and third were days of peak demand in the Los Angeles Metropolitan Area. It was possible to segregate a district containing approximately 404,000 customers in the central portion of the area, and determine the hourly sendouts to the essential customers. Figure No. 6 illustrates the wide variations in hourly demands and also indicates how holder storage assisted in taking care of the heavy daylight demands. At times the hourly demands are so heavy that diesel oil standby plants are placed in operation in order to augment the incoming natural supplies.

Industrial sales may vary according to seasonal load requirements, economic conditions, and competitive fuel markets. Also, curtailment of low rate surplus industrial customers may be necessary during periods of very heavy essential demands during the winter period.

Figure No. 7 illustrates the monthly requirements of the California gas companies, also shown on Figure No. 3, the monthly domestic and commercial sales and the monthly industrial sales. Steam electric generating station fuel was shown separately in order to explain some of the variations in the industrial sales curve.

This concludes the presentation of the natural gas picture in California. The industry has grown to be one of the largest industries in the State and the value of the natural gas produced in 1936, 1937 and 1938 was exceeded by only two others in the mineral division, petroleum and gold.

1 Gas Supply Supervisor, Southern California Gas Company & Southern Counties Gas Company.

2 "Natural Gas Production and Supply in California, 1906-1939." Proceedings of the Pacific Coast Gas Association—1939.

3 "The Possibilities of Pressure Maintenance in California Oil Fields," by A. C. Rubel. Proceedings of the 13th Annual C.N.G.A. Meeting, November, 1938.

4 "Pressure Maintenance of Flush Production and its Value to the Natural Gas Industry," by E. O. Bennett. Proceedings, Natural Gas Dept. of the A.G.A., 1938.

"The Storage of Gas in Depleted Fields," by J. H. Dunn—Gas Age—Feb. 2, 1939.

5 "Utilization of Natural Gas from Oil Field Operations in California," by H. P. George. Proceedings, Natural Gas Dept., A.G.A., 1938.

6 "Some Aspects of Gas Storage in Relation to Conservation in California Oil Fields." Summary of Operations, Division of Oil and Gas, Vol. 15, No. 2—1929.

7 "Recent Developments in Meterology and Their Application to Natural Gas Dispatching," by Charles P. Smith. Proceedings, Pacific Coast Gas Association—1939. "Monthly Climatological Data" (for California)—U. S. Weather Bureau.

Navy Presses Tidelands Claim

Determination of the Navy to take advantage of "national defense" psychology, to take over the country's valuable tideland oil deposits was evident in the testimony of naval oil reserves officers before the Cole oil subcommittee in its hearings last week. Before the oil subcommittee in Washington, Rear Admiral Stuart, director of naval petroleum reserves, suggested that all oil exports from the United States be halted and imports increased to conserve this nation's petroleum resources for a national emergency. He told the committee that the present naval reserves are wholly inadequate for an emergency, that while the Navy's average peacetime consumption of oil is 9,000,000 barrels, in the event of war it would require at least 50,000,000 barrels a year.

JERGUSON

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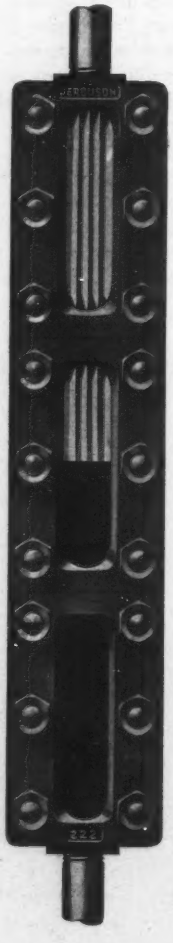

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Alkylation and Its Influence on Utilization of Natural Gasoline Outlined

By
Earle W. Gard, A. L. Blount,
K. Korpi

Before describing our work and the phases of it that may be of interest to the members of the California Natural Gasoline Association, it appears advisable to define alkylation and to describe in general terms what is accomplished by alkylation.

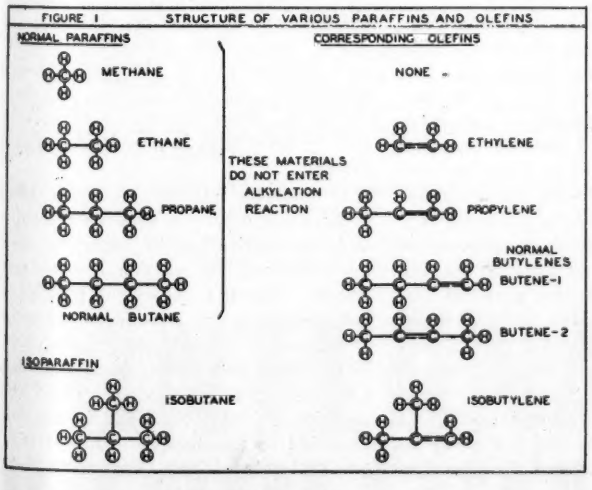
Alkylation is a process by which one or more alkyl groups are introduced into a compound. We shall define these terms by means of diagrams later. In our particular case, alkylation may be rather narrowly defined as the addition of an olefin to an isoparaffin to form an isoparaffin of higher molecular weight, in fact, one having a molecular weight equal to the sum of molecular weights of the reacting olefin and isoparaffin.

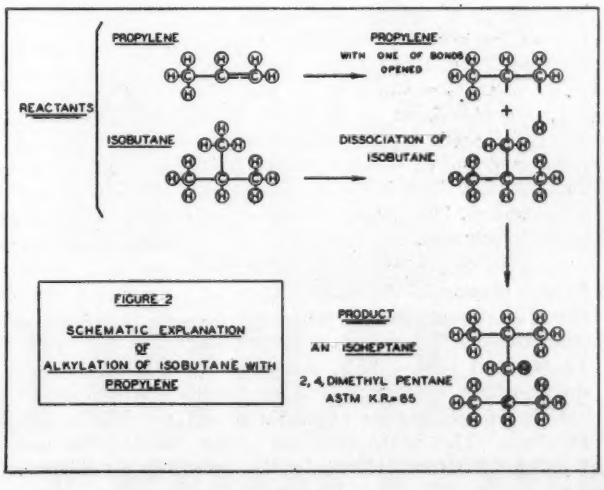
It is difficult to visualize the significance of these technical definitions; therefore, we have prepared a number of figures showing the structure of the materials that are used in the alkylation process and the probable course of the reaction, as well as the principal products of the reaction in each case.

Figure 1 shows the structures of the paraffins, isoparaffins and corresponding olefins that we shall mention in this paper. It can be seen that the normal paraffins are essentially molecules composed of carbon chains with the requisite amount of hydrogen to provide a saturated molecule in every case. The normal paraffins do not enter the alkylation reaction and they are presented here merely for the sake of comparison. The isoparaffin is distinctive from the normal paraffin in that it does not contain the straight carbon chain, by the fact that three and even four carbons are joined with one carbon, whereas in the normal paraffins no more than two carbons are attached to another carbon atom. The isoparaffins which are of particular importance in alkylation contain a distinctive hydrogen known as the tertiary hydrogen. This hydrogen is the hydrogen attached to the carbon atom which is in turn attached to three other carbon atoms. Such a structure does not exist in the normal paraffins. Thermodynamic calculations indicate that the normal paraffins, as well as the isoparaffins, should enter the alkylation reaction, but as yet no catalyst for such a reaction has been found. Therefore, we are primarily concerned at this time with the isoparaffin and its structure and not the normal paraffin. The other reacting materials in the alkylation reaction are the olefins which have structures similar to those shown in Figure 1. It is seen that the olefin has essentially the same structure as the corresponding paraffin except that it has two less hydrogens in the molecule and the two bonds or valences released by the removal of the hydrogens go to form one of the bonds of the double bond of the structure. This double bond is of importance since it is capable of reopening, and the two bonds thus reformed are the points to which the fragments of the isoparaffin molecule are attached. In order to help visualize what we have just said, a number of other figures are introduced.

Presented before C. N. G. A. Annual Fall Meeting, Ambassador Hotel, November 17, 1939.

Figure 2 is a schematic explanation of the alkylation of isobutane with propylene, the simplest of the cases which we shall consider. We have already stated that the isoparaffin and the olefin are the two reacting materials in the alkylation process. In Figure 2 these are exemplified by isobutane, the simplest of the isoparaffins, and propylene. In this schematic arrangement we have shown the two reactants passing through a hypothetical stage during which one of the bonds of the double bond in propylene opens to produce two points at which attachment can be made, and during which isobutane dissociates into two fragments: 1) a hydrogen fragment or radical, and (2) an isobutyl fragment or radical. The next step is the addition of these two fragments to the two valences formed by the opening of one of the bonds in the double bond of propylene. The product of this addition is shown in the lower right hand corner of Figure 2 and is an isoheptane; namely, 2, 4 dimethyl pentane which has an ASTM knock rating of approximately 85. We see, therefore, that isobutane, the isoparaffin, adds onto propylene, or propylene adds onto it, to form a larger isoparaffin which has a molecular weight equal to the sum of molecular weights of the two reacting materials, which was





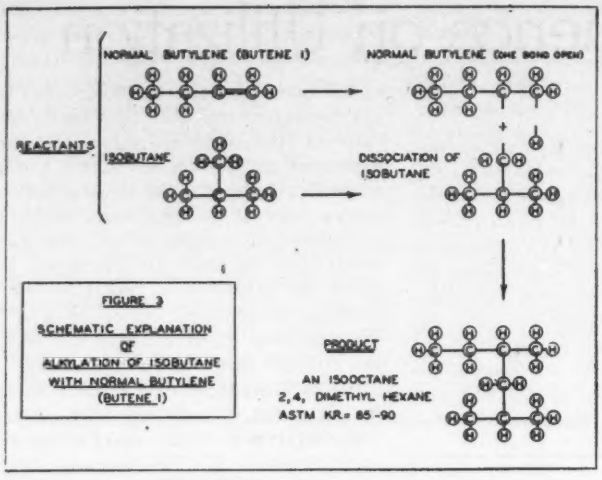


FIGURE 3
SCHEMATIC EXPLANATION OF ALKYLATION OF ISOBUTANE WITH NORMAL BUTYLENE (BUTENE 1)

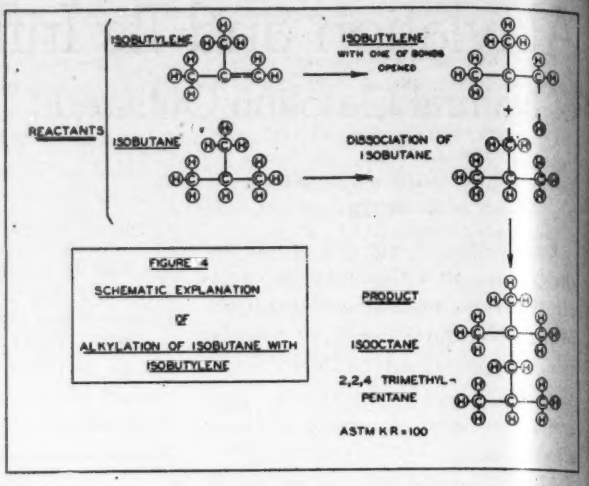
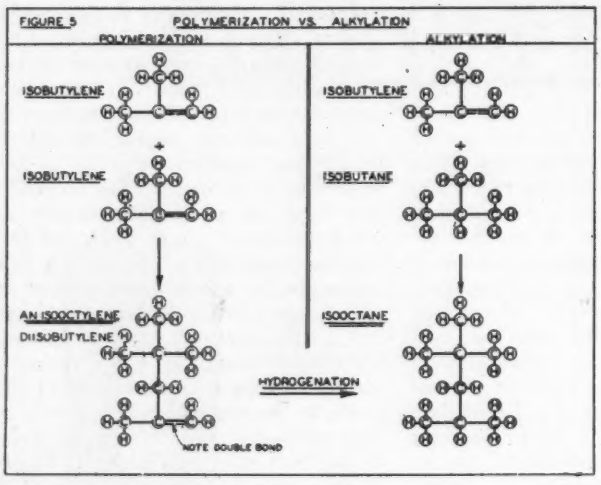
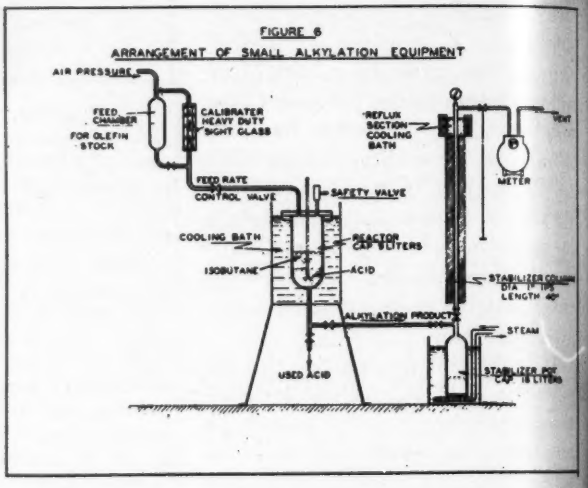


FIGURE 4
SCHEMATIC EXPLANATION OF ALKYLATION OF ISOBUTANE WITH ISOBUTYLENE





previously given as a definition of alkylation.

Figure 3 is similar to the previous figure except normal butylene (butene-1) is used in place of propylene in the reaction. As in the previous case these two materials may be assumed to pass through stages during which one of the bonds in the double bond of normal butylene opens and isobutane dissociates into two fragments as described before. The addition of the isobutane fragments to the valences produced by the opening of the double bond of the olefin produces the product shown in the lower right hand corner, which in this case is an iso-octane. This is not the iso-octane of commerce, but one of the other isomeric iso-octanes.

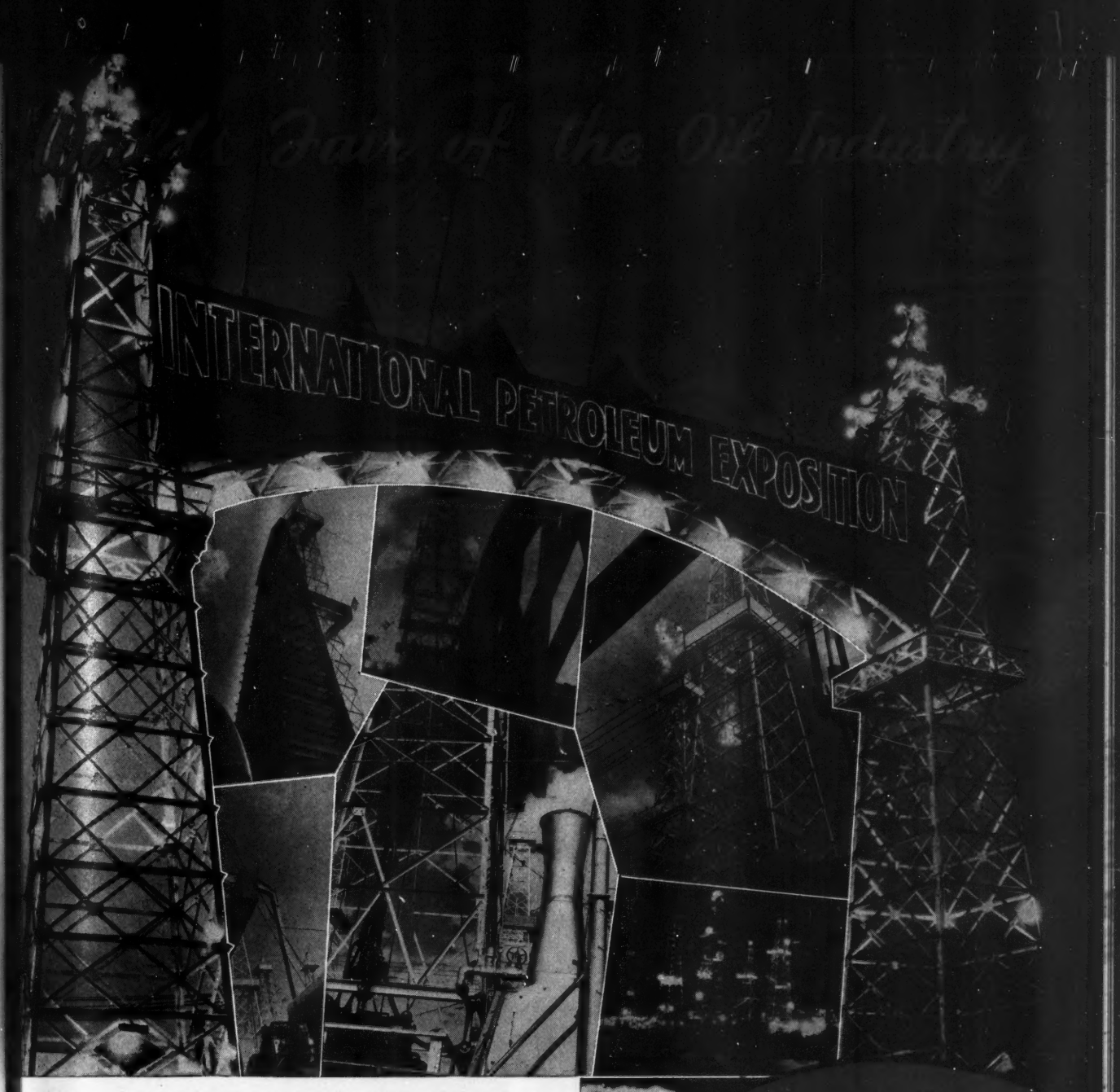
Figure 4 is similar to the other two figures previously described except in this case isobutylene is the olefin instead of normal butylene or propylene. The product is iso-octane, that is, it is the iso-octane which is the reference fuel used in determining the knock rating of gasolines. This is the only one of the three reactions considered in the last three figures that can theoretically produce regular iso-octane directly.

We have shown by means of the last three figures that alkylation is a process by which an olefin as exemplified by propylene, normal butylene, and isobutylene can be made to add onto an isoparaffin like isobutane to form higher boiling isoparaffins.

It should be understood that the alkylation reaction is not as simple as it may appear to be from the reactions shown in the last three figures. In every case substantial amounts of higher and lower molecular weight and different paraffins than the one indicated in each case are obtained. The formation of these by-products is due undoubtedly to secondary reactions which result in breakdown of the first product and buildup of the fragments into other new paraffins and to rearrangement of the first products. It is the opinion of some investigators that alkylation is not a satisfactory designation for the reaction that we are considering and that condensation might be a better one. We are not going to discuss this aspect of the situation further, but are going to leave it with the statement that the principal products of the reaction between the three olefins and isobutane are those shown in the three figures, Nos. 2, 3, and 4.

It will be observed that we have used isobutane alone as a typical isoparaffin. This does not mean that other isoparaffins like isopentane and isoheptane cannot be used in a similar manner. The higher isoparaffins, however, are valuable components of high knock rating motor fuels and very little can be gained, except in special cases, by the alkylation of them with low molecular weight olefins.

It may be interesting at this point to draw a comparison between alkylation and polymerization in order to show the course of the reaction in these processes. Figure 5 shows the parallelism between these two reactions. In polymerization, two molecules of an olefin, in this case isobutylene, react to form a new molecule, iso-octylene, which still contains a double bond and is therefore classified as unsaturated. In alkylation, one molecule of isobutylene reacts with



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Tulsa, Oklahoma, U.S.A.

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INTERNATIONAL PETROLEUM EXPOSITION

one molecule of isobutane to form iso-octane which is a saturated material, that is, does not contain a double bond. The iso-octylene produced by polymerization, however, can be hydrogenated, that is, hydrogens can be added onto the molecule at the double bond, yielding the same iso-octane that is produced by alkylation in the parallel case.

It has been demonstrated that the polymers of the olefins can be used as well as the olefins themselves in the alkylation process. Thus, di-isobutylene, the polymer formed from two molecules of isobutylene as shown in Figure 5, behaves during alkylation as if it were isobutylene, that is, it appears to decompose into the parent mono-olefin. It is necessary, however, to use an amount of isobutane that corresponds with the potential two molecules of isobutylene rather than with one molecule of di-isobutylene in order to realize satisfactory results. Polymerization may be used to concentrate the olefins for use in the alkylation process. It is possible to segregate olefins by polymerization at one locality and ship the polymers, which are concentrated olefins, to another for alkylation. It should be pointed out that considerable additional expense is thus incurred and that direct alkylation of the low molecular weight olefins is probably the preferred process.

The type of alkylation which we are considering has developed through stages over a period of seventy years. The successful alkylation of aromatics with olefins, using aluminum chloride as catalyst, was reported by Balsohn[1] in 1879. Kraemer and Spiker[2] used sulfuric acid as catalyst for the alkylation of aromatics in 1890. Brochet[3] studied the same reaction in 1893 and Ipatieff, Corson and Pines[4] in 1936. The use of phosphoric acid as catalyst for the alkylation of the aromatics was reported by Ipatieff, Pines and Komarewsky[5] in 1936.

The alkylation of paraffins using boron trifloride as catalyst was considered by Ipatieff and Grosse[6] in 1935 and using aluminum chloride as catalyst in 1936[7]. In 1938 and this year three papers have been published by Birch, Dunstan, Fidler, Pim, and Tait of the Anglo-Iranian Oil Company, Ltd. [8 9 10] which summarize the results of their work on the use of sulfuric acid as catalyst for the alkylation of isoparaffins with olefins.

It is seen from the above historical summary that information on sulfuric acid catalyzed alkylation of isoparaffins with olefins has only recently become available. The reaction with which we are dealing is new, so new that we may state with confidence that text books now in use do not discuss it.

The paraffins, which may be understood to include the isoparaffins, have until recent years been considered chemically inert insofar as reactions between themselves and with other hydrocarbons are concerned. The word paraffin is derived from two Latin words, parum meaning little and affinis meaning affinity. This derivation shows how the chemist of yesteryear classified some materials which today display great affinity for the olefins even at temperatures below zero Fahrenheit in the presence of catalysts.

For the information of those who are not familiar with chemical terms, a catalyst is any substance which alters, increases or decreases, the velocity of a chemical reaction without appearing in the end products; however, it may be used up in the process by side reactions. It should be understood that isobutane

[1]See bibliography at end of paper.

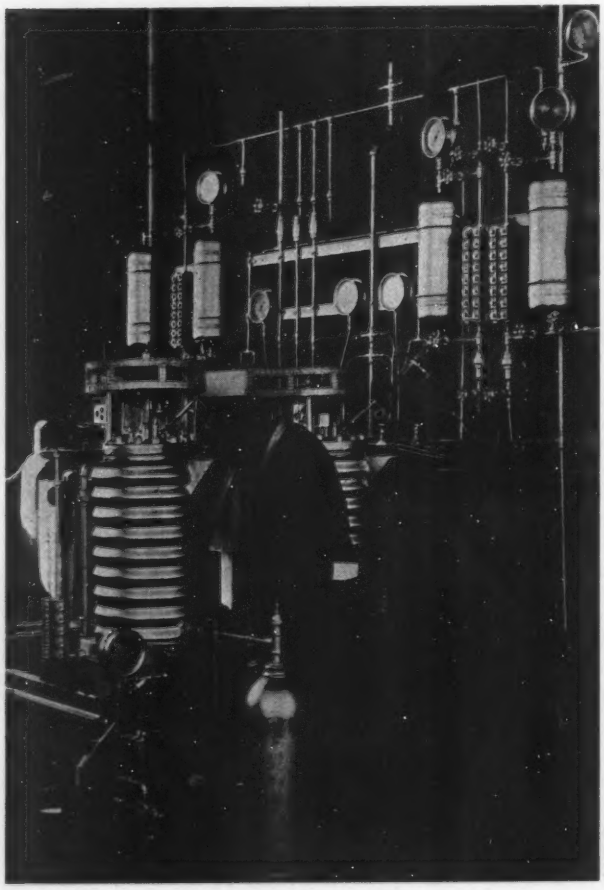


Figure 7. Small Batch Reactors and Feed Chambers.

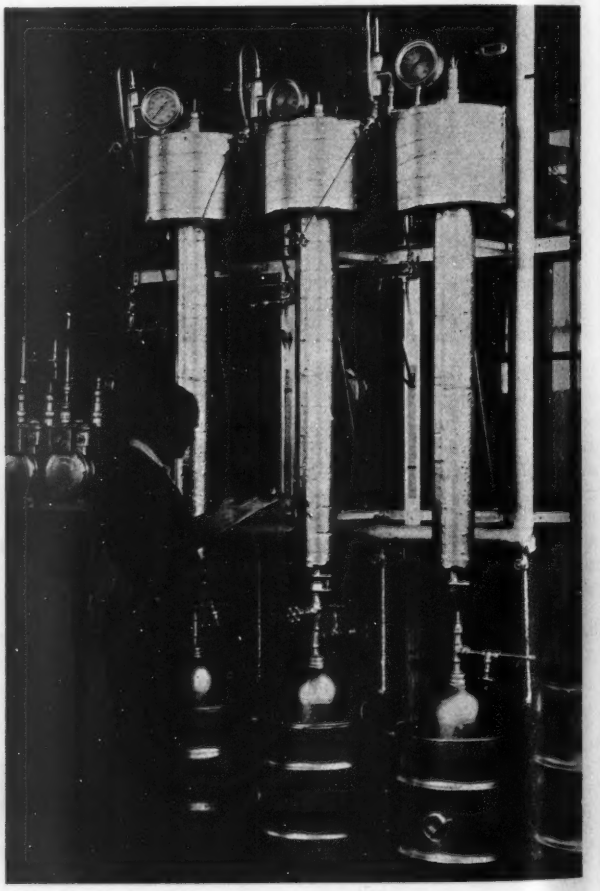
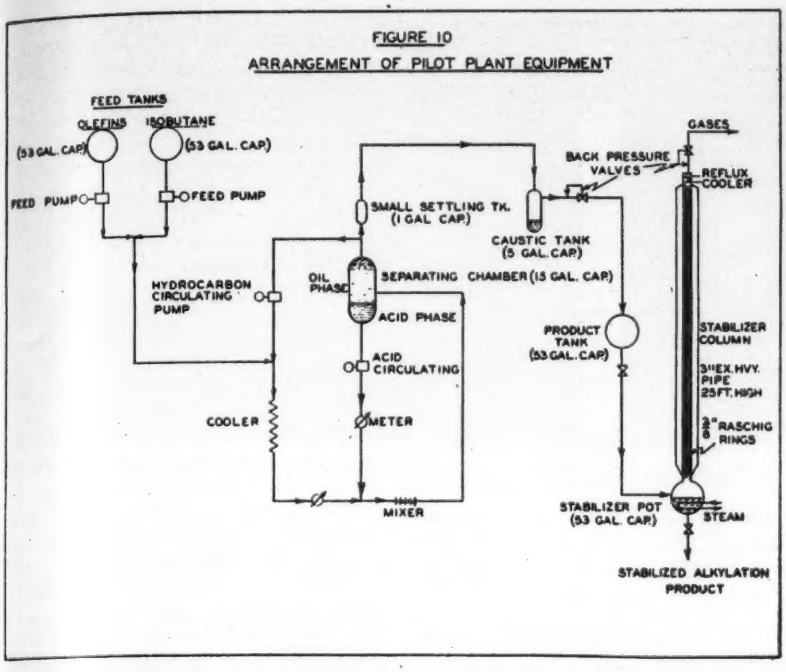


Figure 8. Small Stabilizers.



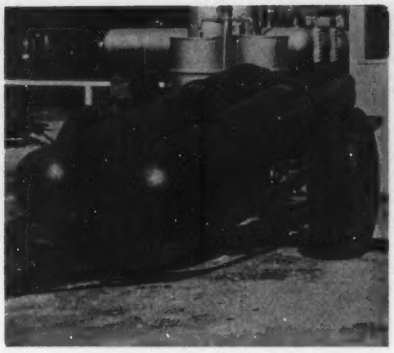


Figure 11. Tank Trailer Used in Handling Alkylation Feed Stocks.

and olefins can exist in the same solution at ordinary temperatures for a very long period of time without reacting one with the other to an appreciable extent. When a good catalytic agent is introduced into the system, a very rapid and fairly complete reaction occurs between olefins and isoparaffins in as short a time as one minute even at subzero temperatures.

Among the substances which have been found to be catalysts for the reaction between the olefins and isoparaffins are aluminum chloride, concentrated sulfuric acid, and chlorosulfonic acid. Our work, however, has been concerned in the most part with the use of sulfuric acid as catalyst. It is interesting to note that one of the first reagents to find use in the

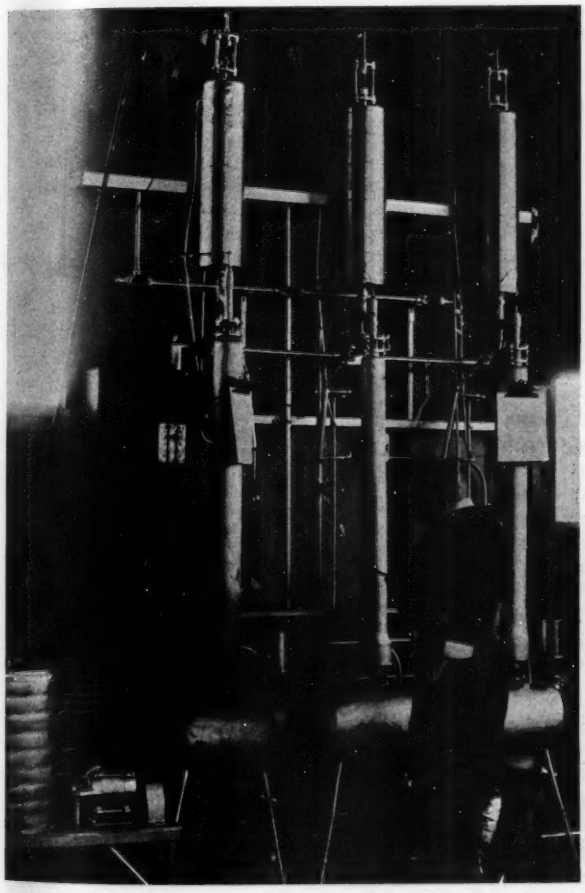


Figure 9. Small Fractionating Stills.

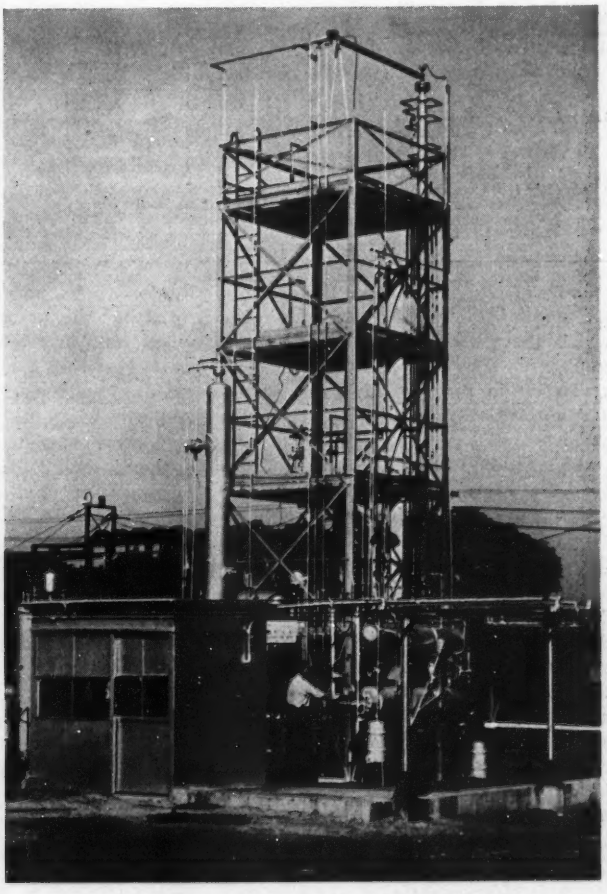


Figure 12. General View of Pilot Alkylation Plant.

TABLE 1
COMPOSITION OF TYPICAL FEED STOCKS USED IN PILOT PLANT OPERATIONS

SOURCE	Mixed Propylene-Butylene Feed: Pressure Distillate Stabilizer Overhead	Propylene-rich Feed: Pressure Distillate Stabilizer Overhead	Butylenes-rich Feed: Pressure Distillate Stabilizer Overhead	Isobutane Feed: Natural Gasoline Stabilizer Overhead
Composition, % by liquid volume				
Propylene	5.5	28.1	1.3	.....
Butylenes	26.0	0.3	32.4	.....
Isobutane	16.1	8.1	29.8	75–80
Other paraffins	52.4	63.5	36.5	25–20
Propylene as % by volume of total olefins	17.5	98.9	3.9	.....

TABLE 2
ESTIMATED PRODUCTION OF OLEFINS AND ISOBUTANE IN CALIFORNIA

	Estimated Annual Production: In Barrels	In Reacting Units (Pound Mols): Olefins	In Reacting Units (Pound Mols): Isoparaffin
Olefins (From cracking still gases)a			
Propylene	400,000	1,720,000	
Isobutylene	400,000	1,500,000	
Normal butylene	550,000	2,080,000	
TOTALS	1,350,000	5,300,000	
Isoparaffins			
Isobutane			
From natural gasoline	1,350,000		4,600,000
From cracking still gases	550,000		1,880,000
TOTALS	1,900,000		6,480,000
Excess			1,180,000b

a. Only the easily recovered olefins are considered.
b. About 350,000 barrels.

TABLE 3
ESTIMATED POTENTIAL PRODUCTION OF 100 KNOCK RATING AVIATION GASOLINE BY THE POLYMERIZATION-HYDROGENATION AND BY THE ALKYLATION PROCESSES

Process	Olefin	Estimated Annual Production of Indicated Olefin in California (Barrels)a	Volume of Polymer or Alkylation Product (Barrels)	Volume of Aviation Fraction (Barrels)	Knock Rating of Aviation Fraction (ASTM Method) (Iso-octane)	Volume of Final Blend Containing 3 ml. TEL/gal. (Barrels)
Selective polymerization-Hydrogenation	Propylene	400,000	b			
	Isobutylene	400,000	300,000	270,000	99	670,000
	n-Butylenes	550,000	250,000c	230,000c	...	.....
	TOTALS	550,000	500,000		93d	1,000,000
Alkylation	Propylene	400,000	600,000	540,000	86	600,000
	Isobutylene	400,000	670,000	600,000	95	1,200,000
	n-Butylenes	550,000	850,000	680,000	92	1,130,000
	TOTALS	2,120,000	1,820,000		91	2,930,000

a. Only easily recovered olefins are considered.
b. Propylene does not polymerize in the selective polymerization processes.
c. No accurate yield data available. Generally polymerized with isobutylene.
d. Probable knock rating of co-polymer of isobutylene and normal butylene.

refining of oils is a catalyst for promoting one of the newest reactions with which the petroleum technologists are concerned. The role of sulfuric acid as a catalyst in the alkylation reaction is undoubtedly that of bringing the olefin and isoparaffin close enough together to make reaction possible. It is beyond the scope of this paper to discuss the mechanism of the sulfuric acid catalysis of alkylation, and we shall leave it with the few remarks already made.

The foregoing has ben a broad introduction to alkylation. We have endeavored to show the probable course of the reaction, the type of materials that react one with the other, and the general character of the products of alkylation. We shall now describe our experimental work, the results of which have to a certain extent been anticipated in what we already have presented.

Small-Scale Experimental Work

The first attempt to alkylate an isoparaffin with an olefin was prompted by thermodynamic calculations which indicated that the reaction should take place under suitable conditions. Some of our work has been done in small-scale laboratory equipment which is diagrammatically explained in Figure 6. This equipment consists of a feed chamber equipped with a calibrated sight glass, a reactor surrounded by a constant temperature bath, a product receiver which also functions as a stabilizer pot, and a small stabilizer or fractionating column with its necessary flow control and measuring devices. The operation of the small-scale alkylation equipment is as follows:

A volume of isobutane and concentrated sulfuric acid is placed into the reactor. This mixture is agitated by means of indicated agitating equipment. The olefin or olefins are gradually added over a period of several hours to the mixture of isobutane and sulfuric acid which is maintained at the desired temperature. After the desired amount of olefins has been added, the acid is removed and the hydrocarbon phase is drawn into the stabilizer pot which contains a small amount of caustic soda to neutralize any entrained acid. The unconverted isoparaffin and olefin or olefins and inert materials are removed in the fractionating column while the contents of the stabilizer pot are gradually reduced to a stable or low-pressure condition. An idea of the general character of the small-scale alkylation equipment may be gained by reference to Figures 7, 8, and 9 which are pictures of reactors, stabilizers, and the small stills used in the laboratory work. We shall not dwell on the operation of this equipment more than to state that it was found by experiments therein that certain important variables had to be controlled for optimum results. It was found that it was necessary to use a substantial excess of isobutane and to add the olefin feed stock at a slow rate in order to promote alkylation and to avoid undesirable polymerization. It was also found that the use of sulfuric acid with a concentration in excess of 90% H_2SO_4 was necessary to promote a satisfactory reaction. With this information as a basis a pilot plant was designed and constructed.

Pilot Alkylation Plant

The general features of the pilot plant are shown in Figure 10 and some idea of its size may be gained from the pictures designated Figures 11, 12, 13, and 14.

On reference to Figure 10 we see that in the pilot plant the unsaturated feed stock, which is an overhead from the refinery pressure distillate stabilizer, and the isobutane feed, which is an overhead fraction from the natural gasoline stabilizer, are placed in separate feed tanks. These two materials are pumped independently into a circulating stream composed of the inert hydrocarbons contained in the feed stocks, excess isobutane, and the alkylation product. This stream is circulated through a cooler and meter, and it is brought into contact with the acid stream which is withdrawn from the settling tank. The mixed stream of acid, circulating stream and feeds, is passed through an orifice mixer into a settling tank where separation into hydrocarbons and acid phases occurs. From there on the cycle repeats itself. The circulating system and settling tank are completely filled with liquid and therefore the introduction of feeds into this system causes a corresponding amount of circulating stream containing the alkylation product to pass through the caustic scrubber and back-pressure valve into the product tank. The product is periodically drawn from the product tank into the stabilizer pot

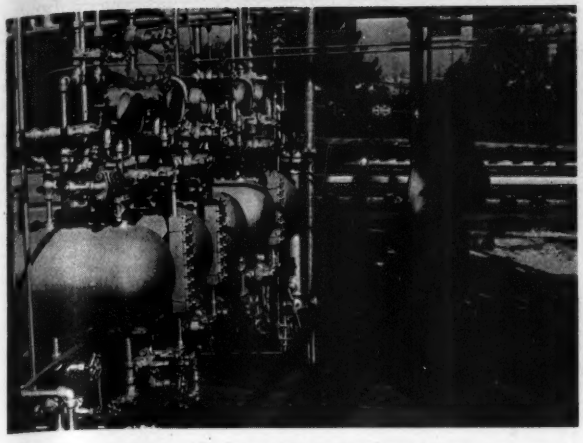


Figure 13. Pilot Plant Feed Tanks.

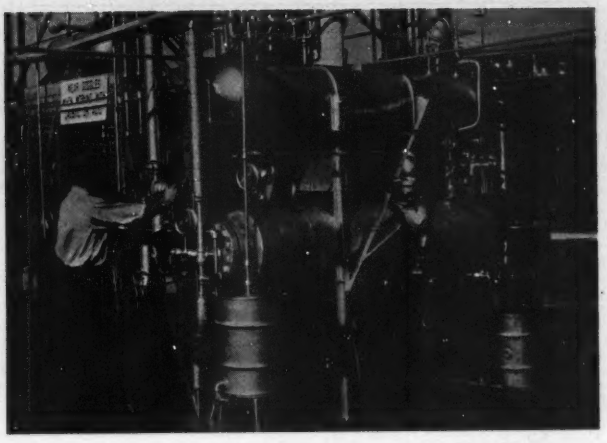


Figure 14. Product Tank and Stabilizer Pot in Pilot Plant.

and is stabilized therein by removal of the light fractions of inert material and excess isobutane through the stabilizer column.

Figure 11 is a picture of one of the tank trailers used in the transportation of isobutane and olefinic feed stocks from the refinery stabilizer to the pilot alkylation plant. Figure 12 is a picture of the pilot alkylation plant showing the structure required to support the stabilizer column . Figure 13 is a picture showing the arrangement of the feed tanks, some of them holding isobutane and some the unsaturated or olefinic feed stock. Figure 14 is a picture of the product tank and stabilizer pot.

The Results of Pilot Plant Operations

For the sake of brevity, we shall not attempt to discuss all of the phases considered in the pilot plant operations. A large number of runs were made, each one lasting one to four days. Many of these runs were made to determine optimum conditions for large-scale operations and others were concerned with various theoretical aspects of alkylation.

Most of the pilot plant and small-scale experiments were made with refinery fractions as feed stocks. The general nature of these stocks is listed in Table 1. Reference to the table shows that three olefinic fractions were used, (1) a mixed propylene-butylenes stock which was the reflux in the pressure distillate stabilizer, (2) a propylene-rich feed, and (3) a butylenes-rich feed. The last two feeds were prepared from (1) by fractionation. The isobutane used throughout the work was a refinery fraction produced at the natural gasoline stabilizer and generally contained about 80% isobutane, the remainder being propane and normal butane.

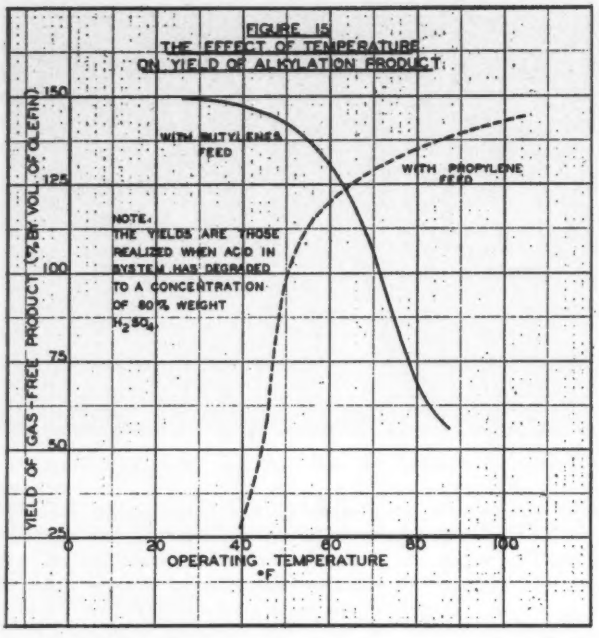
Runs were made to determine the best operating temperature. Figure 15 is a summary of the results of the work on this phase. It is seen that when the olefins in the feed stocks are butylenes, a temperature of about 30°F. produces the best yield. When the only olefin is propylene, a temperature in excess of 80°F. is necessary for good yield. With mixed feeds (containing both propylene and butylenes), some intermediate temperature is required. Experiments have indicated that when propylene and butylenes are present in equal molal amount, operation at approximately 55°F. produces the best results.

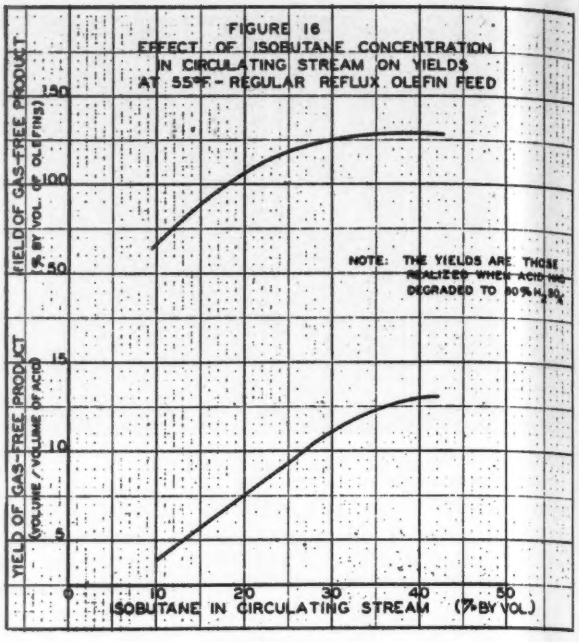
Experiments were made to determine how much excess isobutane was required to produce optimum yields under otherwise constant conditions. A summary of this work is shown in Figure 16. It will be seen that the yield increases markedly as the amount of isobutane in the circulating stream increases to about 35%. This latter concentration is maintained by the introduction in the feeds of about two and one-half times as much isobutane as is required to react theoretically with the olefins in the feed stock.

Some further insight into the influence of composition of feed stock and operating temperature on yield and acid life may be gained from a study of Figure 17. In this case we have selected the results of four pilot plant operations on three different types of feed stock. In three of the runs the optimum temperature for best results was used. It is seen that with a propylene-rich feed of the character described in Table 1, 80° F. was a better operating temperature than 50° F. The yield considered in Figure 17 is the cumulative yield at the time the indicated gallons of olefins have been introduced into the system. The significance of the results of the run with propylene-rich feed at 50° F. is clouded by the fact that at this temperature propylene dissolves in the sulfuric acid to a very substantial extent and the rate of alkylation is slow. The solution of the propylene in the acid causes a rapid decrease in the apparent strength of the acid in the system, and the slow rate of alkylation is reflected in the poor yield of alkylation product. At 80° F. the alkylation reaction is quite rapid; however, acid life is short probably due to the side reactions which are prominent at this temperature. Theoretically, higher temperatures should produce better yields, but our work indicates that the life of the acid is very short in any case when the operating temperatures exceed 100° F.

When the olefins in the feed are principally butylenes and the temperature of the operation is 30° F., a relatively long acid life is realized, as is indicated by the volume of olefins that can be introduced before the acid begins to decrease rapidly in strength. It is also apparent that the cumulative yield reflects this fact. When a mixed propylene-butylenes feed, containing about 17% propylene and 83% butylenes on the total olefins basis, was used at the temperature of 55° F., the acid life and cumulative yield characteristics are influenced adversely from those obtained with butylenes in proportion to the amount of propylene in the feed stock. The data of Figures 15 and 17 lead to the conclusion that propylene will produce as high a yield of alkylation product as does butylenes but that the acid life is much shorter with the lower olefin, and that mixed feeds containing both propylene and butylenes can be used in the alkylation process with satisfactory results provided appropriate operating conditions are used.

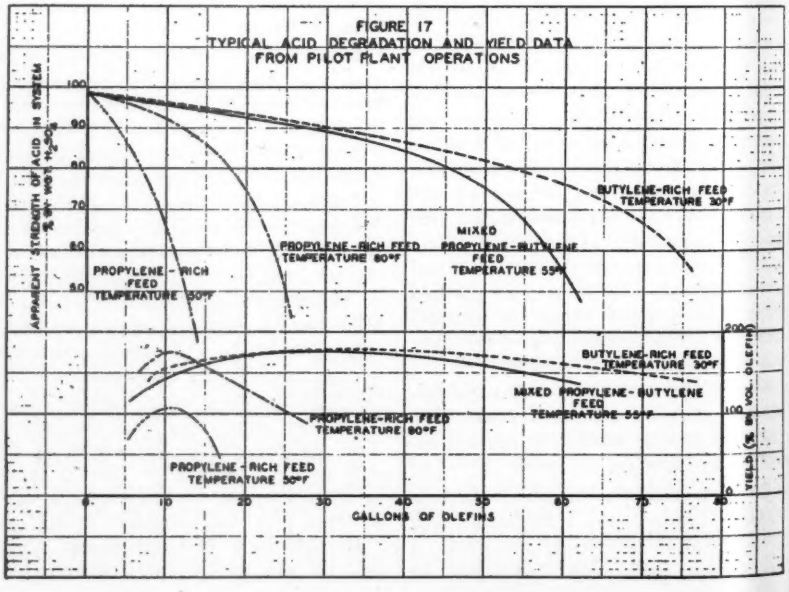
In the early part of this paper we indicated by means of structural diagrams the character of the alkylation product obtained from various olefins. Thus propylene and isobutane should yield a product containing principally seven carbon atoms in the molecule and it would be expected that butylenes and isobutane

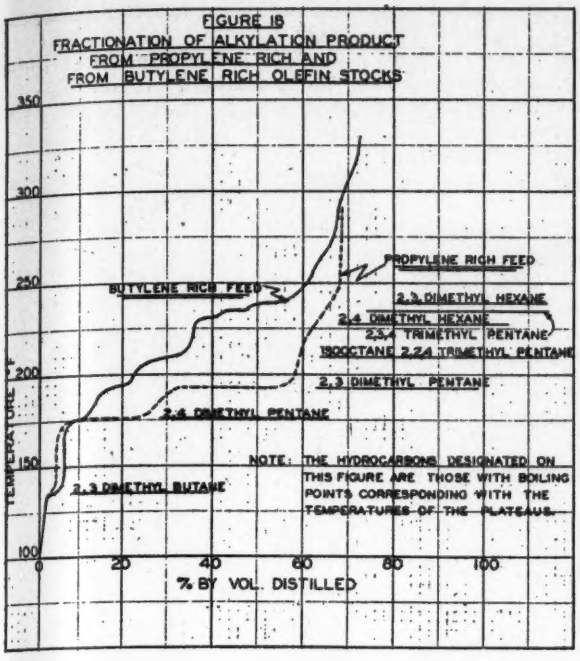


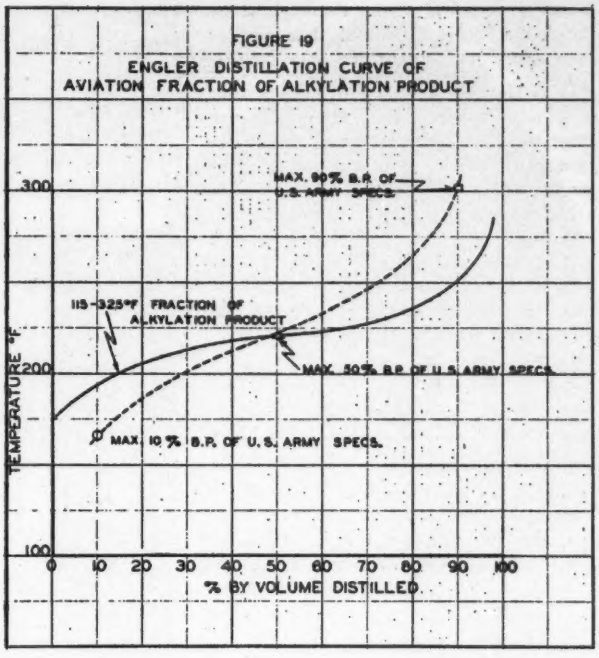


would yield principally octanes, that is, hydrocarbons containing eight carbon atoms in the molecule. These expectations are realized to a substantial extent as will be seen by reference to Figure 18 which is a fractionation of the alkylation product produced in one case from a butylenes-rich feed and in the other from a propylene-rich feed. The fractionation curves of those two alkylation products showed definite plateaus or horizontal segments at temperatures corresponding with the boiling points of the hydrocarbons listed on Figure 18. It is seen that the first plateau in the product from the propylene-rich feed corresponds with a hexane (2, 3 dimethyl butane), the second with a heptane (2, 4 dimethyl pentane), and the third with another heptane (2, 3 dimethyl pentane). It is seen that 80% of the 68% of the material taken overhead, the remainder being gaseous materials and bottoms, is composed of seven carbon atom hydrocarbons. The composition of the alkylation product from the butylenes-rich feed is obviously more complex. However, about 55% of the 72% taken overhead in this case boils in the range of the various octanes. These data indicate that alkylation is not as direct a reaction as was indicated by the schematic reactions shown in Figures 2 to 4, inclusive, and that some breakdown into smaller molecules and some buildup into larger molecules than those shown in the earlier figures occur. Furthermore, the reactions discussed in the first part of this paper indicated a buildup of hydrocarbons with substituents in the 2 and 4 positions. The fractionation analyses and other data not presented show a substantial production of materials with methyl groups in the 3 position, which is undoubtedly due to some different mechanism than that previously described, possibly isomerization or rearrangement of the first products of the reaction.

In most of this work we have been concerned with an olefinic stock which is a light overhead from the pressure distillate stabilizer and contains a substantial amount of propylene, as well as butylenes. This material, as is indicated by the fractionation curves of Figure 18, should contain C_6, C_7, and C_8 hydrocarbons, and is therefore distinctive from iso-octane, produced by selective polymerization and hydrogenation of olefins, which is composed almost entirely of iso-octane. It is necessary to blend iso-octane with light straight-run material in order to obtain a satisfactory motor fuel complying with the distillation specifications of the U. S. Army Air Corps. The alkylation products obtained from mixed propylene-butylenes feed and from the butylenes-rich feed contain, as has already been stated, high knock-rating hydrocarbons lighter than iso-octane, and they are therefore more nearly a finished aviation gasoline than is iso-octane. This will be appreciated by reference to Figure 19 which shows the Engler characteristics of the 115° to 325° F. fraction of an alkylation product from mixed propylene-butylenes feed. It is seen that this fraction has a slightly higher 10% boiling point than is speci-







fied by the U. S. Army Air Corps specifications for 100 grade aircraft engine fuel. This fraction, however, was cut in such a way as to exclude pentanes which might be present in the feed stocks that we used, and if these had not been eliminated or if a light fraction, such as pentane cut from crude, had been added, an entirely satisfactory product complying with the Army Air Corps specifications would have been obtained.

Our tests indicate that, by choice of the olefinic feed stocks used in the alkylation process and by blending of the product with suitable straight-run fractions, aviation gasolines can be produced which will comply in every respect with the specifications of the Army and Navy departments for 87 (unleaded) and 92 and 100 octane number aircraft fuels of various lead contents.

The Potentialities of the Alkylation Process

Many of us have read articles which indicate the potentialities of the process under discussion by figures showing how much of the new product may be produced from available raw materials. In some cases, the estimated potential production of the new material is truly astounding. Thus Egloff, et al.[11] estimate that "more than 9,000,000,000 gallons (approximately 214,000,000 barrels) of polymer gasoline may be produced yearly from hydrocarbon gases in the United States, of which more than 1,000,000,000 gallons (approximately 24,000,000 barrels) may be iso-octane fuel of 95 to 100 octane rating."

We are going to be conventional and use data which we have obtained from various sources to estimate how much aviation gasoline can be produced by alkylation from the isobutane available in natural gasoline produced in California and the olefins obtained as a by-product from California cracking operations.

The basis of these estimates is tabulated in Table 2. The olefin production figures were obtained from the reported volume of cracking stock charged to still in California during 1938 (see Bureau of Mines, Minerals Yearbook, 1939), and the results of analyses of cracked gases from our operations. The isobutane production was obtained from a study of the monthly reports of the California Natural Gasoline Association which include the amount of 21-pound vapor pressure natural gasoline produced in various fields in California. These figures were converted to a basis of a hypothetical 40-pound vapor pressure gasoline which would include all of the isobutane. Information as to the isobutane content of 40-pound vapor pressure natural gasoline from the various fields was available, and therefore the calculation of the isobutane production from these figures was simple arithmetic.

A study of the data of Table 2 shows that if all of the easily-recovered olefins in cracking still gases and all of the isobutane in natural gasoline were available in one place, there would be a fairly satisfactory balance between the two reactants. The excess isobutane amounts to about 18% of the total available. When it is appreciated, however, that some isobutane is sold with normal butane as liquefied gas for domestic heating it is questionable whether any excess of isobutane over that required for the alkylation of the available olefins exists.

It should be interesting at this point to introduce an estimate of the quantity of 100 knock rating aviation gasoline that could be produced annually from potentially available olefins in California by polymerization-hydrogenation and by alkylation. A summary of such data is contained in Table 3. A review of this information leads to the conclusion that almost three times as much gasoline complying with the Army Air Corps specifications for Grade 100 Aircraft Engler Fuel can be produced by the alkylation process as by the polymerization procedure.

It is estimated that 2,100,000 barrels of alkylation product could be obtained from the olefins produced in California each year. The aviation gasoline fraction would amount to about 1,800,000 barrels annually, and it would have a clear knock rating of about 91 iso-octane (ASTM method). This fraction would be rated 100 iso-octane by the ASTM and Army methods when it contains not more than 1.5 ml. of tetraethyl lead per gallon. By blending with suitable straight-run fractions as aviation gasoline with a knock rating of 100 iso-octane and containing a maximum of 3 ml. of lead per gallon could be produced in an amount equal to about 2,900,000 barrels per year.

It is estimated that the present yearly local demand for aviation gasoline with a knock rating in excess of 86 (ASTM) equals about 400,000 barrels. Therefore, it appears that the potential annual production of aviation gasoline by the alky-

lation process is from four to seven times the present annual demand for such fuel.

It is the opinion of the authors that it is not economical at present to use alkylation as a process for the manufacture of a blending stock for use in regular motor fuels. Aviation gasoline with a knock rating of 100 iso-octane is selling at present for 15 to 16 cents a gallon. The margin between the selling price and the cost of the material is relatively small considering the size of the investment for plant equipment. It is estimated that alkylation plant costs about $2500 per barrel of product per day which is about eight times the cost of a cracking plant on the same basis.

It is obvious that companies with refinery facilities can use some of the existing equipment in connection with the alkylation plant and thus reduce the initial expenditure. The extent of the reduction, however, is dependent on the availability of such existing facilities for the new use.

In conclusion we may summarize this phase of alkylation by the following statements:

1. The alkylation product is uniquely useful in the preparation of high octane aviation fuels.

2. The present market, excluding wartime demand, will consume about one-fifth of the present potential production from the easily recovered olefins and isobutane.

3. The present cost of producing the alkylation product precludes its use in the preparation of regular motor fuels.

4. The cost of an alkylation plant is relatively high per barrel of product.

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Union's New Tanker Honors Victor H. Kelly

Union Oil Co. of California's new tanker, now being built at the Bethlehem Steel Corp.'s Sparrows Point Yard near Baltimore, will be named the VICTOR H. KELLY, according to an announcement released by W. L. Stewart, Jr., vice president. Progress on the construction of the new vessel, a sister ship of the L. P. ST. CLAIR, has been very rapid, and indications are that she will be ready to launch early in January, and will take her place in the service with the remainder of the Union tanker fleet about March 1, 1940.

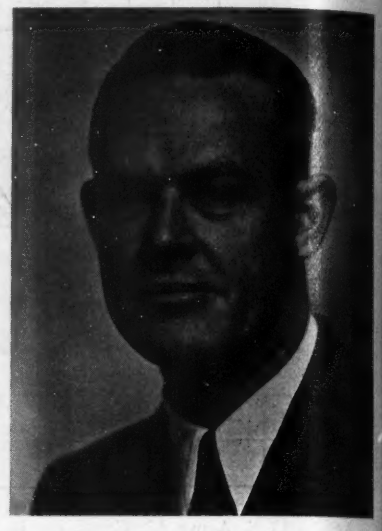
Victor H. Kelly

V. H. Kelly, in honor of whom the ship will be named, has been associated with Union Oil Co. for over 26 years, and is well known throughout the industry. Beginning his employ with the company in 1913 as a salesman at Tacoma, his hard work and application to his duties earned him a series of promotions in the succeeding years, through which he was elevated to the position of northern division manager. Following a successful regime in the northwest, he was transferred to Los Angeles in 1929 as chairman of the Sales Committee, and two years later was appointed director of sales. His election to the vice presidency took place early this year.

Glenn E. Henderson Entering Oil Business

Glenn E. Henderson, for the past five years vice-president and sales manager of Mills Alloy Inc., has severed his connection with that company and will re-establish himself in some branch of the petroleum industry following a short vacation.

Mr. Henderson's experience in the oil business started in 1920 when he went to work for the D & B Pump and Supply Co. When D & B was taken over by Emsco Derrick and Equipment Co., Mr. Henderson was made manager of the San Joaquin Valley Division where he stayed until 1933.



Glenn E. Henderson

After a year of handling sales in the Los Angeles Basin for Pacific Pump Works, Mr. Henderson moved over to Mills Alloy Inc., as vice-president in charge of sales, where he has been until the present time.

During the past two years, Mr. Henderson has also been trustee for the benefit of creditors in the liquidation of the assets of the Long Beach Boiler Works, a job that he is completing at the present time. He resides at 2946 Hill Street, in Huntington Park.

A. P. I. Board Adds California Directors

Among the new directors elected by the American Petroleum Institute at its 20th Annual Meeting in Chicago this week were five prominent California oil men and one supply man. The newly elected Californians are: L. L. Aubert, Bankline Oil Co.; W. M. Keck, Superior Oil Co.; Reese H. Taylor, Union Oil Co. of California; R. K. Davies, Standard Oil Co. of California; Neal Anderson, oil producer; and J. A. Crawford, Republic Supply Co. of Calif. These are in addition to a number of California men already on the board.

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California Petroleum Engineers Contribute to Splendid A. P. I. Program

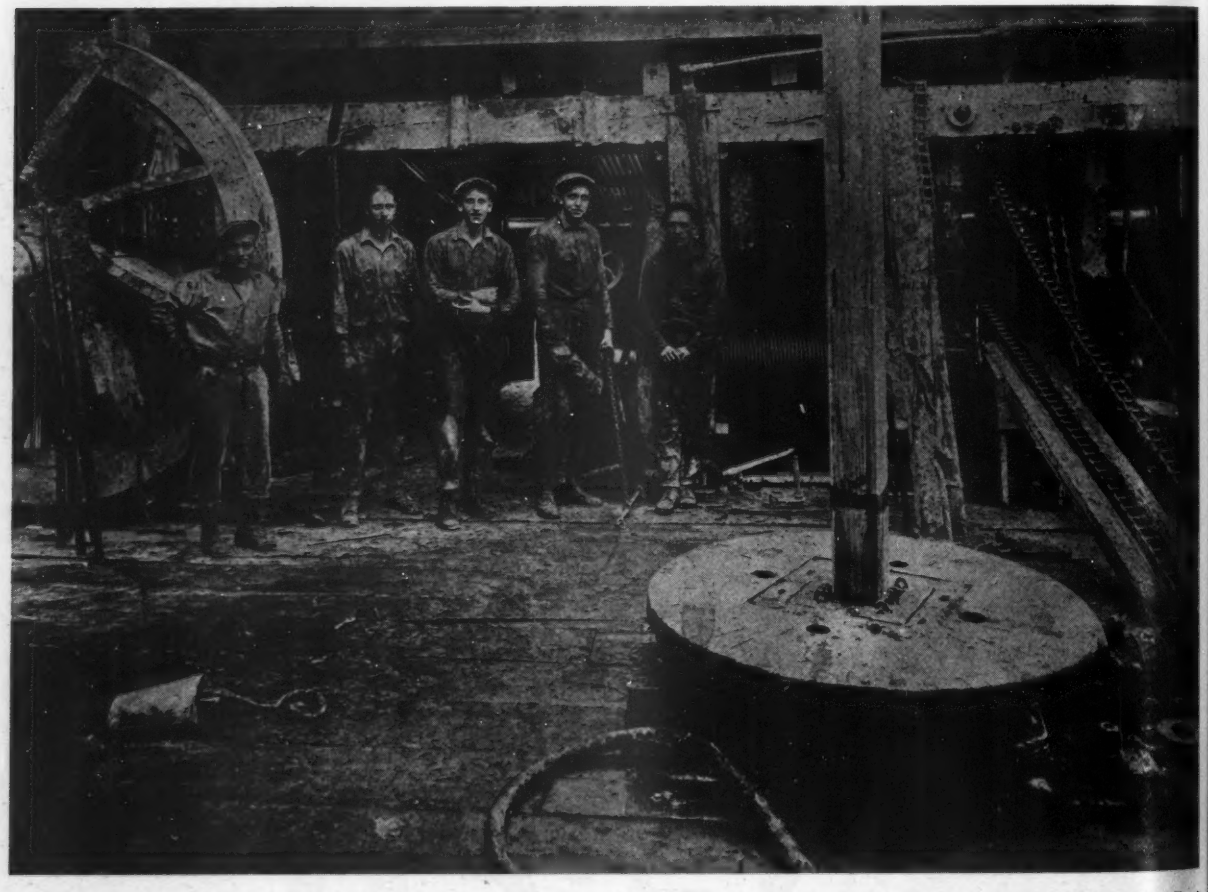
Possible future economies in the production of crude oil from some fields through scientific determination of the optimum size of well holes and an accurate evaluation of the application of induced gas pressures in lifting oil from underground pools were suggested in two papers read before the American Petroleum Institute's 20th Annual Meeting attended by more than 3000 oil men in Chicago.

Study of the effect of varying well-bore diameters in California fields has revealed that the present trend to smaller well diameters may not be fully justified when long-term production economics are considered, Ernest K. Parks, consulting petroleum engineer, of Los Angeles, reported to the Institute's Division of Production group session on Production Practice and Materials.

Although only enough data were gathered to indicate the importance of further study, Mr. Parks said the experience of some drilling crews indicated that even the previously-accepted reason for drilling smaller well holes—a reduction in drilling costs—is not always valid. Records of small and large diameter wells drilled in the same field under nearly identical conditions showed that occasionally the larger wells were less costly. Effect of the well size on cumulative future production, and on possible future difficulty with production equipment, and the value of larger holes as insurance against drilling trouble, were among the many other factors which should be carefully studied before accepting the small well-hole as most economic.

Extensive use of gas pressure induced into sub-surface oil formations in various ways has proved the immeasurable value of these and similar methods in increasing the amount of oil produced from an oil sand, E. C. Babson, of Union Oil Co. of California, Compton, Calif., told the session. Until recently no valid basis has existed for evaluating accurately the behavior of the gas lift to obtain predetermined results. Lack of knowledge of flowing pressures, and of the quantities and properties of the fluid mixtures, in the past has reduced to cut-and-dry methods the problem of getting the optimum application of the gas lift to each well in which it was used.

Mr. Babson presented results of a detailed investigation of the problem, with comparisons of five different gas-lift methods and suggestions for applications of the results to actual production practice. Evaluation of the formerly unknown factors and their proper application to



After reading in our last issue that R. W. Jerman and Jack Rogers, rival Long Beach deep well operators were old buddies, Engineer Homer Dulin contributed this photographic proof. Taken in 1920 on a well being drilled for Honolulu Consolidated Oil Co. by McKeon Drilling Co., Cathead Man Rogers and Driller Jerman are pictured respectively third and fourth from the left. Midway between the locations of the two deep Signal Hill wells, John McKeon is planning to follow the example of his former crew by drilling to the 10,000 ft. zone.

the economic problems of the flowing oil well should result in lower over-all costs per barrel of oil ultimately produced from the well, Mr. Babson stated.

A detailed summary of the problems involved in selecting and applying the correct protective coatings to petroleum equipment, particularly steel, was made by C. F. Rassweiler, of E. I. du Pont de Nemours & Co., Inc., Philadelphia, Pa. He recommended an engineering approach, with separate analysis of each specific coating problem, weighting the various properties wanted and selecting and applying the proper coating based on this analysis. Twelve primer and eleven finish-coat properties that might be considered were listed.

Adoption of a standard formula for rating cylindrical and tapered roller-bearings as used for oil-field equipment was recommended to the session by C. R. Athy, International-Stacey Corp., Columbus, Ohio. Selection of roller bearings to meet the unusual bearing loads of modern drilling and production operations with long-range economy has been a petroleum engineering problem ever since the less-costly plain bearings became inadequate, Mr. Athy said. He proposed a load-rating formula for tentative adoption as standard by the Institute, the formula's quality factor to be established by endurance testing in the laboratory.

A newly perfected device, discussed in two papers, is known as the pressure core barrel. Its application in the oil fields makes possible a much more accurate estimate of the oil in a given pool as of the nation's total oil reserves. Analyses of the earth samples also facilitates prediction of the type and characteristics of oil to be produced from any given field.

In the two papers presented detailed operation of the core barrel was described and illustrated in diagrams and illustrations. One of the papers was presented by D. B. Taliaferro and R. E. Heithecker, of the U. S. Bureau of Mines Petroleum Experiment Station, Bartlesville, Okla. The pressure core barrel discussed by those two authors is a development of the Bureau of Mines in cooperation with the American Petroleum Institute. The other paper devoted to the pressure core barrel was that of Ben W. Sewell, of The Carter Oil Co., Tulsa, Okla.

The pressure core barrel consists of a core drilling tool, equipped with a system of valves, vents, and plugs. Lowered into the well, it takes the earth sample at the pressure and the temperature existing at the depth of the oil pool. The pressure and the tempreature are maintained as the sample is withdrawn from the well, thus retaining the identical conditions found at the well bottom. The gas which accompanies the oil is not permitted to escape from the sample and the oil content of the core is determined as accurately as though the laboratory instruments were taken into the earth and the examination made at the well bottom.

Results to be obtained from use of the pressure core barrel, as outlined by Mr. Sewell, include a more certain determination of the nation's oil reserves than is now possible, the location of gas caps which ordinarily cover an oil pool, and greater ease and accuracy in the study of the oil remaining after the apparent depletion of older oil fields. Detailed study of the cores brought to the

If you can't name at least five of these petroleum engineers and geologists, you should start attending meetings of the A.A.P.G., A.I.M.E. and A.P.I. That's the only way to keep pace with a fast moving industry.

And now

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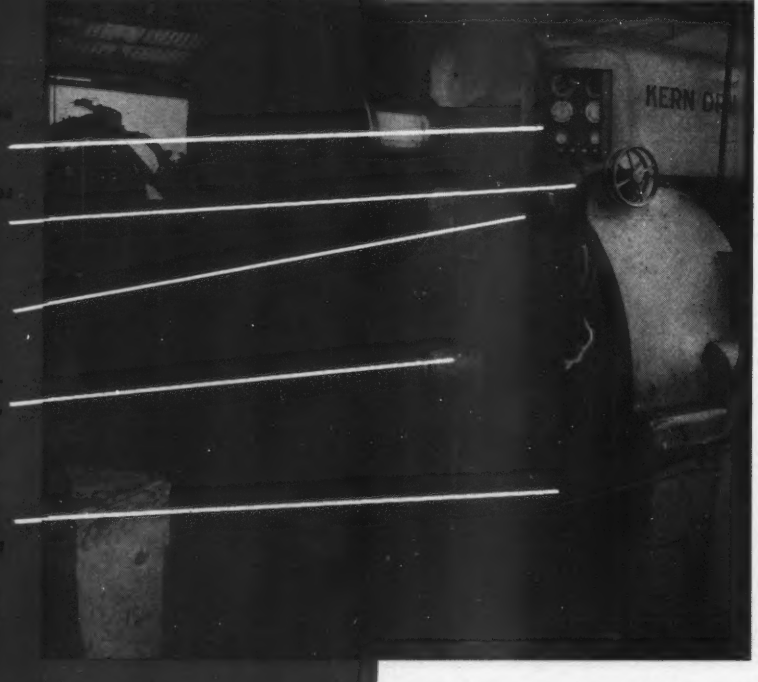

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The PETTIJOHN DRILLING COMPANY, 512-13 Richfield Bldg., Los Angeles —another wide-awake progressive drilling organization, uses only the best equipment to assure the most efficient service. They have recently put into service a new WILSON "TITAN" Drilling Rig. The WILSON "TITAN" was selected because of superior and exclusive features

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surface, both the papers disclosed, will aid in adopting the most efficient methods and rates of production in any oil field.

"Engineers have been handicapped in estimating fluid content of petroleum reservoirs with precision," Mr. Taliaferro and Mr. Heithecker reported, "because many necessary data were lacking. The need for core samples obtained under the bottom hole pressure has been recognized, but the method of obtaining such samples was not available until the pressure core barrel was introduced." Pressure cores have been taken from as deep as one mile and under pressures as great as 2,800 pounds per square inch. Cores 6 feet long and 6 inches in diameter have been brought to the surface and the natural pressure maintained during laboratory tests.

The device now being developed cooperatively by the Bureau of Mines and the Institute is to be made available to the industry generally upon completion.

Another device for examination of crude oil samples under conditions identical to those at well bottom was described and its operations illustrated at today's production Session by Paul G. Exline, of Gulf Research and Development Co., Pittsburgh, Pa., and H. J. En-Dean, of Stanolind Oil & Gas Co., Tulsa, Okla. The instrument was designated as a rolling-ball viscosimeter, designed to determine the viscosity of crude oil as it is found in the earth at temperatures ranging from 80 to 200 degrees and under pressures as high as 4,000 pounds to the square inch. As in the pressure core barrel, the crude oil is removed under its bottom-hole pressure and transferred to the viscosimeter for examination without loss of pressure.

Analyses of crude oil under conditions existing at the well bottom, the authors of the paper indicated, permit an accurate calculation of the quality and the chemical characteristics of the oil to be produced and aids in the quantity of oil and the most effective production methods.

B. H. Sage and W. N. Lacey, California Institute of Technology, Pasadena, Calif., delivered a paper on the volumetric behavior of the paraffin hydrocarbons which included a method of measuring the volume which a given amount of hydrocarbon gas will occupy under given conditions of pressure and temperature. The paper was a report on a research project of the American Petroleum Institute.

Indefinitely suspended is Richfield's deep test on Wheeler Ridge.

Cole Tells A. P. I. Members Federal Oil

Control Only Effective Production Curb

Regulation of oil production by state conservation laws is bound to fail, proponents of federal control believe, and the federal government must step in to legislate in the "no man's' between present state and federal legislation, Representative William P. Cole, of Maryland, stated before the American Petroleum Institute's 20th annual meeting in Chicago.

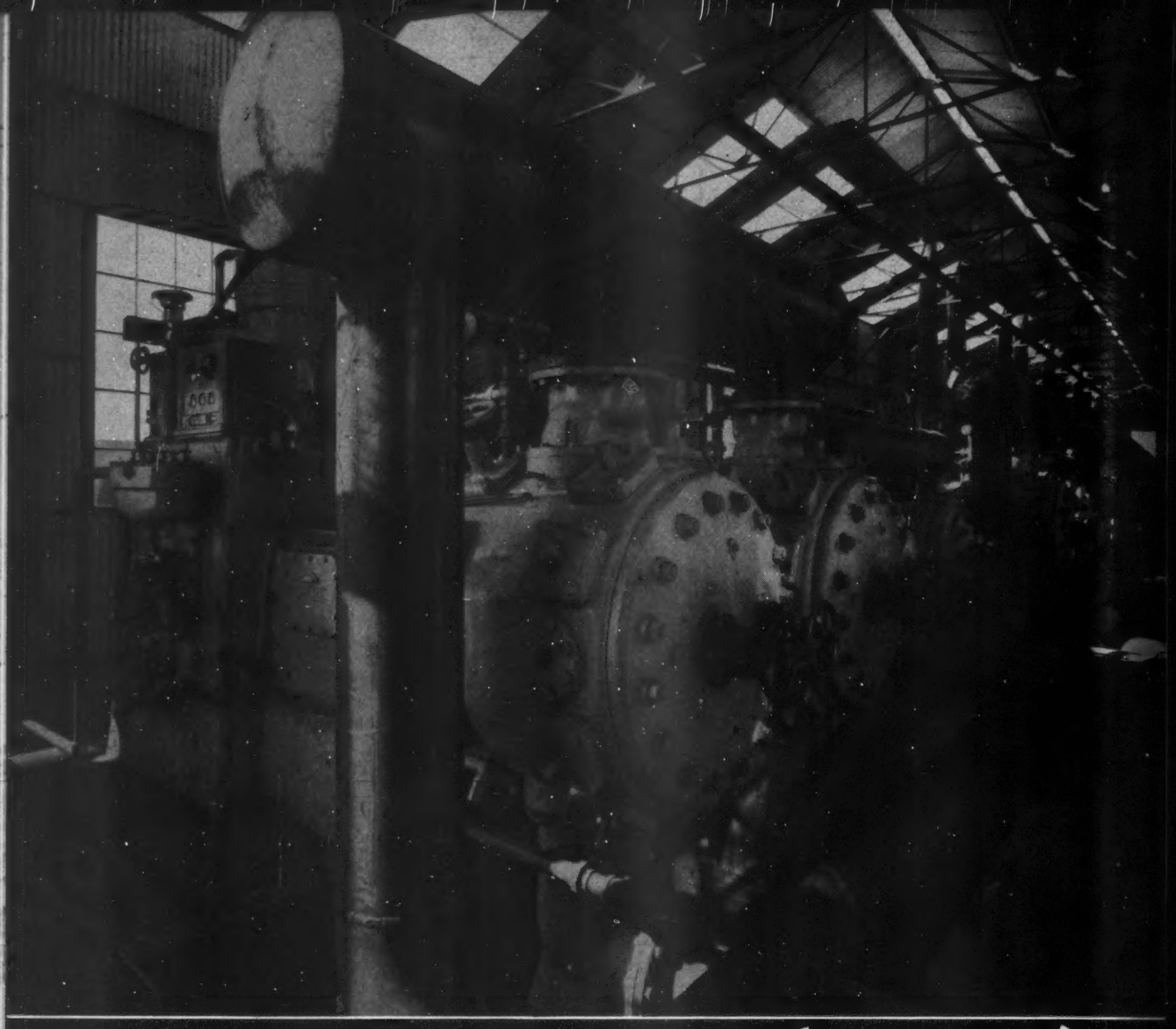
The sponsor of the Cole Bill, designed to provide for federal oil-production control, and chairman of the congressional committee which last week began hearings on the bill, HR372, told the general session of the Institute's 20th annual meeting that the first week's testimony, indicated to many the inability of all the states to meet the problem of preventing avoidable waste in oil production.

"There are those who believe that state regulation, after a reasonable period of trial, has failed in the matter of prevention of avoidable waste to the degree the nation should expect, and is not likely to prove effective in the future," Mr. Cole declared. "But whether state regulation has failed to such an extent that the enactment of this legislation is necessary is a question on which I express no opinion. Perhaps our committee will be able to form an opinion."

The Supreme Court would consider evidence indicating inability of the states to control as favoring the constitutionality of the bill, Mr. Cole said. He traced other constitutional questions involved, quoting pertinent decisions which he said supported the bill's constitutionality. He asserted that any possible unconstitutionality because the original bill did not specify the wasteful methods and practices it proposed to prohibit would be considered by the committee.

Right of the states to control oil production has been recognized by the committee, Mr. Cole admitted, but added: "We have felt that the problem is not too big for the states if they sincerely want to solve it; at the same time, the problem is not one which will tolerate

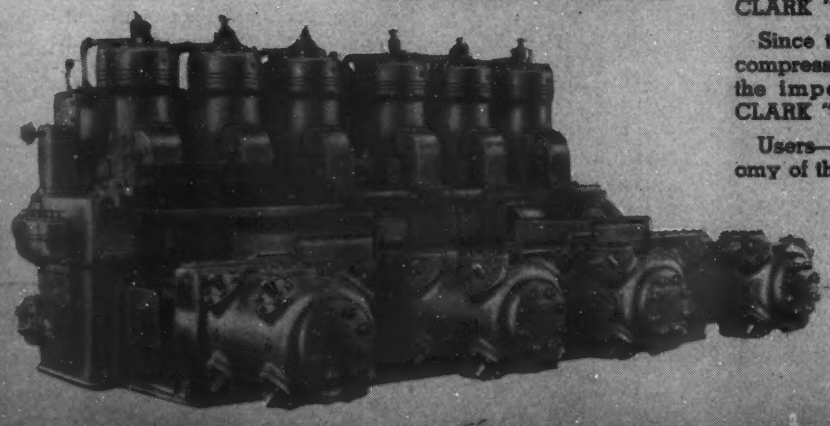
(Continued on Page 32)



4200 H.P. of CLARK "ANGLES"

now being installed in a new West Texas gasoline plant

CLARK "Angles" in this 600 H.P. size are used in the new gasoline plant shown above, now under construction in West Texas.



Big installations of CLARK "Angle" Compressors [illegible] new users, and repeat orders from old customers—[illegible] tinue to evidence the favorable findings of oil [illegible] engineers as to the efficiency and economy of [illegible] CLARK "Angle."

Since the introduction of this compact, higher [illegible] compressor, in 1936, an amazingly large proportion [illegible] the important compressor installations have [illegible] CLARK "Angles."

Users—once they experience the reliability and [illegible] omy of the CLARK "Angle"—invariably come back [illegible] additional units. The battery at right also [illegible] is one of 3 installations on a property

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2400 H.P. of CLARK "ANGLES"

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K.M.A. Field. The first order was for 5 4-cylinder, H.P. CLARK "Angles" and was received in June. Three more were ordered in March, 1939, five in July, 1939.

llow us to explain in detail the important economies duced by this machine, in transportation, installa- fuel consumption and maintenance.

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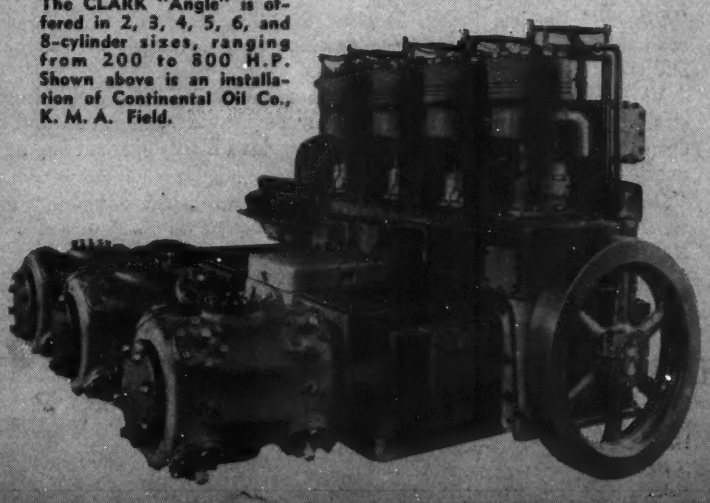
The CLARK "Angle" is offered in 2, 3, 4, 5, 6, and 8-cylinder sizes, ranging from 200 to 800 H.P. Shown above is an installation of Continental Oil Co., K. M. A. Field.



RK

Nos. 12 and 12-D *(12" x 12")*

One of several "Oilwell" No. 12-D Engines used by a leading operator, drilling deep wells in San Joaquin Valley, California. On one well it handled 9600 feet of 5 9/16", 22.2 lb. drill pipe and 13,957 feet of 4½", 18.1 lb. drill pipe in 120-ft. stands. Round trips were made in approximately 6½ hours. The clutch sprocket on the extended crank shaft drives the core reel.

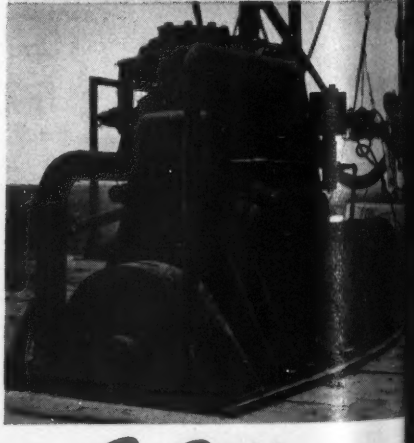
You Get *TRUE POWER* with "OILWELL" Vertical Twin-Cylinder Steam Engines

No. 9 *(10" x 9")*

Driving one of the world's largest power slush pumps (7¾" x 20") in the world's deepest oil field is the job of this "Oilwell" No. 9 Engine at Wasco, California. The No. 9 Engine is also used effectively for individual rotary drive and for hoisting (single or double engine drive).

No. 7 *(7¾" x 7")*

An "Oilwell" Rotary Drilling Unit powered by an "Oilwell" No. 7 Engine made history in penetrating 5000 feet of heaving shale in Texas' deepest well (13,728 feet at Agua Dulce). The No. 7 Engine is also used effectively for driving power slush pumps and for hoisting (single or double engine drive).



"Oilwell" Vertical Steam Engines are recognized for their dependability, economy and the *true horsepower* which they develop—not for massive size and great weight.

Vertical construction permits higher speeds and greater power in relation to size. Wear-and-tear is minimized. Variable cut-off assures fuel and feedwater economy. ***"Oilwell's"*** range of sizes provides a highly efficient engine for every application.

"Oilwell" Vertical Steam Engines have established enviable performance records throughout the oil country, including the far-away oil fields of Arabia, Bahrein, Roumania, Trinidad, and South America.

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Purchasing Personalities

By Leo S. Busby
Associate Editor, Southwestern Purchasing Agent

Oil Company Buyers' Group

There's many a weighty problem dissolved into nothingness in the blue smoke of an after dinner cigar. It was probably some such thought that prompted the recent organization of the Oil Company Buyers' Group by the members of the Purchasing Agents' Association of Los Angeles.

The group is headed by Chairman Bill Brooks, district purchasing agent of Standard, with Don MacPherson, purchasing agent of Gilmore, as secretary. Luncheon meetings are held once a month for general consideration of problems common to all buyers in the oil industry. Round table discussions is the order of the day with all members participating.

The interest in these meetings displayed by the oil company buyers has been agreeably surprising, and it is confidently felt that from the blue haze of those luncheon cigars will come an answer to many of the purchasing problems of the industry.

Petroleum Night

November 9th was Petroleum Night at the regular monthly dinner meeting of the Purchasing Agents' Association of Los Angeles held at the Elk's Club. The program was in charge of the Oil Company Buyers' Group with Bill Brooks, of Standard, acting as master of ceremonies. Working with Bill on the committee were Harold Pierce, of Robert S. Lytle Company; John Peat, of Shell Oil; and, Al Pateracki, of Wilshire.

After a short but highly amusing program of music and entertainment put on by Al Pateracki, the evening settled down to serious business.

Dick Guiberson, president of W. R. Guiberson Company, was introduced by Bill Brooks, and gave a very interesting talk on "The Growing Pains of the Industry." He was followed by Bill Pemberton, California State Oil Umpire, who discussed the "Development of the Petroleum Industry in California." Mr. Pemberton's talk was exceedingly interesting and enlightening and we noticed a number of the non-petroleum members listening with wide-eyed attention. We believe they really had their eyes opened.

Mr. Bronson, of the Baash-Ross Tool Company, then presented an exhibition of modern fishing tools and methods. With the model derrick and model tools giving an actual working demonstration, it was most effective. Petroleum Night was definitely a credit to the industry.

Congratulations!

H. C. Farquhar, manager of purchases for Union Oil Company of California, has recently completed his thirty years of continuous service in the organization. He began his association with the Company as a price clerk for the Union Well Supply Company, a purchasing subsidiary of Union Oil, and through a series of promotions later became purchasing agent for the concern. Upon the dissolution of the Union Well Supply Company in 1913, when Union Oil Company organized its own purchasing department, Mr. Farquhar assumed the duties of assistant purchasing agent. In 1922, he was made purchasing agent. Two years later he became manager of purchases, the position he holds in the organization at the present time.

For many years Mr. Farquhar has been a member of the Purchasing Agent's Association of Los Angeles, and the National Purchasing Agents Association. In the latter organization, he has been active on the Oil Buyers' Committee.

In addition to being a capable business man, Mr. Farquhar is something of a gentleman farmer, spending most of his spare time at his beautiful Newhall ranch. A bridge enthusiast, he enjoys nothing better than a good bridge game for an evening's entertainment.

Congratulations, Mr. Farquhar, may we take this opportunity to wish you 30 more with 76!

Change of Locale

Stop us if you've heard this one—Ben Hogan, for three years purchasing agent for Tunnell, Wood & Neilan, is now opening his morning mail behind the P. A.'s desk of the Howard Supply Company. On October 1st, Ben took his letter opener and moved out to Vernon. Jack Roe has assumed the purchasing duties for Tunnell, Wood & Neilan, Inc., and has accepted a new letter opener. They do say it's a blonde!

Some Boot

Suppose some Saturday afternoon you sat in the Coliseum watching a football game and you saw a halfback kick a field goal from the 50 yard line, what would you do? You'd probably slip that bottle off your hip and swear a large oath never to touch the stuff again. But wait—pick up your tongue-loosener and listen.

It is the fall of 1915. South Dakota Wesleyan is playing Northern Normal. The score is 7 to 6 against South Dakota. It is the last quarter, four minutes to play. South Dakotas ball in midfield, fourth down and six yards to go. The quarterback calls for a punt—what else? A halfback steps back, signals are called, and the ball is snapped. Instead of punting, the halfback drops the ball gently to the turf and with lots of oomph places a drop-kick squarely between the goal posts for three points and the old ball game. A record kick of 62 yards, measured and attested to by referee Carberry of Notre Dame. Miraculous, you say? Right!

And who was the young phenomenon with the timely and prodigious toe? Believe it or not, he was Mark D. Payne, All-State half-back of South Dakota in 1914 and 1915, and right now the assistant purchasing agent for the Gilmore Oil Company.

Observers tell us that certain salesmen of the blustering, aggressive type invariably approach Mark with the greatest of deference. And yet why should anyone resent being kicked out by an expert?

A Really Big Gun

People of these days are more or less war conscious but we'll bet the residents around the Pan Pacific Auditorium couldn't believe their eyes when a huge, formidable looking cannon was parked in the middle of Beverly Boulevard a couple of weeks back.

A few minutes later the phone rang on Dan Hudelson's desk in the Purchasing Department of General Petroleum.

"Hey," an excited voice cried. "I got a 156 millimeter rifle out here blocking traffic on Beverly Boulevard. Where the h—— does it go?"

Dan is a captain in the Division Headquarters of the California National Guard, and was in charge of the military exhibition given by the Guard this year at the Los Angeles Automobile show. The ugly looking weapon was brought down from Santa Barbara and was among the most interesting features of the show. It shoots a gigantic shell approximately eleven miles.

Dan, by the way, has recently been promoted to a staff officer's post, Assistant G-3, Plans and Training Section, on the staff of General Storey, commanding officer of the 40th Division, California National Guard.

Incidentally, Dan's boss, Bill Beck, manager of purchases, is a Reserve Captain in the Guard, and if fate should decree that Uncle Sam join the fracas, General, no doubt, will contribute a pair of future generals to the cause.

Purchasing Agents High Jinks

We look forward to again seeing many of our friends at the Purchasing Agents Annual Hi-Jinks to be held at the Elk's Club on Friday, December 1st. This is a stag dinner party, and all purchasing agents and their friends are cordially invited. There'll be special events that are really something, refreshments that are stag-gering, and the entertainment—well, it won't be anything you can write home about. You'll get off in a corner and speak of it in whispers.

Those Late Vacationers

Somehow, we've always held that there must be just the tiniest hint of meanness in the nature of a man who schedules his vacation late in the season, and then, after all other vacations are over, regales the boys with details of his coming trip. We don't know if Mart Newell, chief clerk of the purchasing department at Associated, did much regaling but we do know he just got back from a fishing trip at June Lake. Our own inherent meanness permits no offer of sympathy for his lack of results. However, we do say, better luck next time, Mart, and remember, June Lake was probably so named because of the the excellent fishing—in June.

Another one of those "fellas" is Emery Squires, of Richfield. Emery just returned and he reports the weather was ideal, the view was grand, the meals were the best ever, and he acquired a swell coat of tan—in his own back yard. Seems that men will never learn that early spring and early fall are favorite housecleaning periods.

Still another disciple of the procrastinated vacation is Phil Lipschultz, of Shell. Phil went up to San Francisco to take in the Fair and to try to take some of his old cronies. Used to live up there, you know, before he and Ralph Emerson exchanged locales.

Condolences

It is with the deepest regret that we learn of the tragic death of Mrs. Maude McGurn, wife of A. J. McGurn, assistant purchasing agent of the Union Oil Company, on Friday, November 10th. We are sure that Lex's host of friends in the oil industry join us in extending to him our sincerest sympathy in his bereavement.

(Continued from Page 27)

abandonment or trifling by the states."

He quoted California and Illinois as states where many difficulties are attending attempts at state regulation, and cited the recent discovery of oil in Nebraska where, he asserted, "the whole story may repeat itself because the state has not passed regulatory measures and is not likely to do so once the race of competitive drilling gets under way."

Mr. Cole repeated statements by President Roosevelt and Secretary of the Interior Ickes supporting the bill, and stated that the President told him again recently that "his interest in the prevention of avoidable waste in the production of oil and gas is stronger than ever today; that he desires the work of the committee to be continued; that, as stated on many previous occasions, he prefers state regulation, but if such state regulation is not available, or if when available is not resulting in waste prevention, then federal action is the only alternative."

Although he devoted his speech to a defense of the "proponents" of the bill he sponsored, Mr. Cole asserted his intention of keeping the opinions of himself and of his committee completely unbiased until representatives of the petroleum industry and of the states have had an opportunity to study the statistical testimony presented last week, and have stated their side of the case. Mr. Cole said he expected that testimony will not be completed until after Congress convenes in January 1940.

Dehydrogenation, Alkylation, Isomerization, Cyclization, etc., Need Not Alarm Refiners

In his splendid paper, "Petroleumization—1940," Hugh W. Field, of Atlantic Refining, discussed the numerous new processes for manufacture of high octane gasoline in plain language before the annual meeting of the A.P.I. in Chicago. His definitions and descriptions are presented here for the benefit of readers who do not find copies of the A.P.I. papers available. Copies of all the papers may be read in the office of the California Oil World.

By Hugh W. Field
Atlantic Refining Company

The textbook of organic chemistry which has rubbed shoulders for so long with the piping handbook and the instrument catalogue on the bookshelf of the refinery office shows fresh thumb prints. The chapter on polymerization and the definition of a catalyst were reread carefully two years ago. Last year the index was leafed in vain in an effort to locate "hydrocodimer"! And now, smudges are in evidence on the hitherto-clean pages dealing with isomerization, alkylation, cyclization, and aromatization. The refiner, who for half a century has been handling one of the most complex mixtures of organic chemicals known to man, at last is talking organic chemistry—or, at least, he is in there trying! Although he does not know how to make it, he has found out that neohexane is 2,2-dimethylbutane, having astounding anti-knock value. Should he equip to manufacture neohexane, should he put in an alkylate plant, would it be the best bet

Most of the talks were not for publication, so————

to try catalytic cracking, or should he forget all about the whole business until somebody straightens out the tangle?

It is the purpose of this paper to attempt, in as plain language as possible, to place these various new processes on the checkerboard of petroleum refining, and determine which ones are competitive, which are complementary, and which should be considered for use as various refinery situations arise. However, due to the extremely-undeveloped state of some of these processes, a certain amount of forecasting based on personal opinion is woven into the pattern presented here, but it is hoped that this simplification and rationalization will assist the thinking which is necessary for the analysis and comparison of information which will be made available as time goes on. Discussion of the details of the operation of all of these various processes is beyond the scope of this paper; and, further, no comparison will be drawn between commercially competitive processes directed toward the same result.

Definitions and Descriptions

A certain number of definitions and descriptions will be useful in our study of the situation; and if these definitions do not agree exactly with the organic textbook, it should be remembered that they have been drafted for "petroleum-ization" rather than for the broad field of general organic chemistry.

Catalyst

A catalyst can be defined as a substance which, although present during a chemical reaction, apparently does not enter into the reaction but causes, by its presence, a change in the conditions under which that reaction occurs. Thus catalytic reactions offer a possibility for product control by selective acceleration of certain reactions which, in the opinion of many, is the most important phase of this new refining technique.

The Pacific Section of the American Association of Petroleum Geologists at their 16th annual meeting recently in Los Angeles, heard nationally known speakers discuss topics and theories which may incubate for months or years before they are confided to printer's ink.

On this and following pages appear pictures taken at the two-day meeting.

E. E. Rosaire, who has developed an unbelievably sensitive analytical method of prospecting.

Hydrogenation

The hydrogenation process adds hydro-

——————The audience had to concentrate and remember.

An Accurate Measurement of Value

The same degree of accuracy that is used to develop Tretolite formulas for the treatment of cut oil to pipe line requirements can be used by you in measuring the comparative value of Tretolite. Speed, dependability and economy of Tretolite are known factors, and it is Tretolite that is used as the standard of comparison whenever treating cut oil is discussed. It pays to deal with known measurable quantities.

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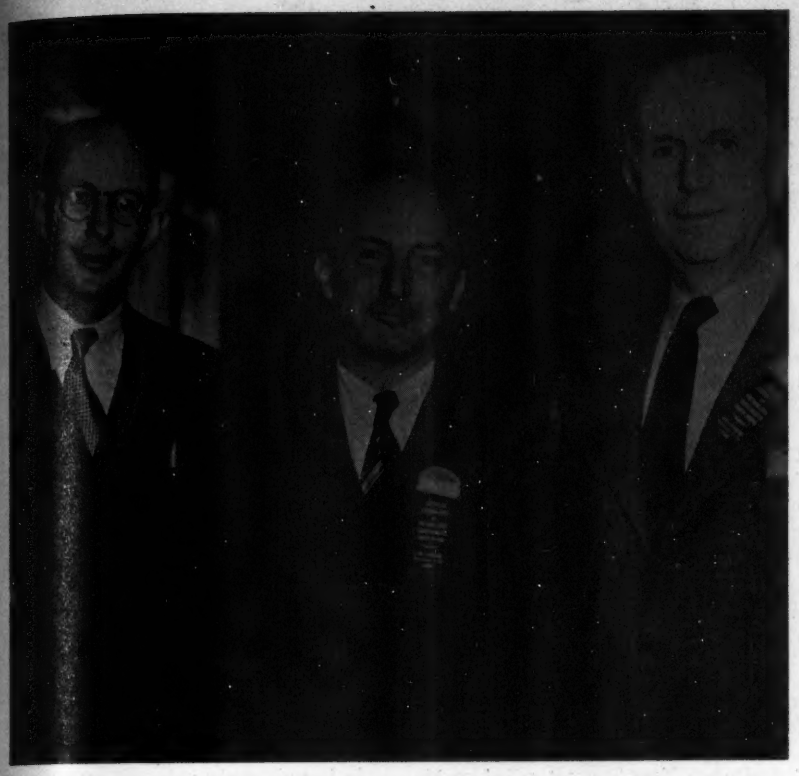

Three of the cognocenti at the A.A.P.G. Pacific Coast Fall meeting. Left to right: Chester Cassel, The Texas Co.; E. J. Bartosh, Bankline Oil Co., new section secretary, and Albert Gregersen, The Texas Co., new president.

gen to the hydrocarbon molecule. Hydrogenation may be either non-destructive or destructive. In the former, hydrogen is added to the molecule only if, and where, unsaturation with respect to hydrogen exists; thus the boiling range of the product is substantially the same as that of the charge to the process. In the latter, operations are carried out under conditions which result in rupture of some of the hydrocarbon chains (cracking); the hydrogen adding on, in general, where the chain breaks have occurred. A change in boiling range results from this type of hydrogenation, the degree of change depending on the operating conditions. Non-destructive hydrogenation is generally a low-temperature low-pressure operation, whereas destructive hydrogenation operates at high temperatures and high pressure. Catalysts are employed in almost all hydrogenation processes.

Dehydrogenation

The general uses of this term is so broad that it is practically useless. For example, the cracking of gas oil in an early Burton still involved dehydrogenation. For the purpose of this discussion, the term will be limited to operations on material in the gasoline boiling range, or lighter, and considered in two categories, as was done for hydrogenation, i. e., non-destructive and destructive. Non-destructive dehydrogenation is defined as the removal of hydrogen from the hydrocarbon molecule without the cracking which would change significantly its boiling range. Destructive dehydrogenation removes hydrogen from the molecule, but is accompanied by chain rupture to some degree. Catalysts are employed for the non-destructive dehydrogenation, but the destructive dehydrogenation may be carried out either with or without catalysts—depending on the degree of selectivity desired.

Polymerization

Broadly speaking, polymerization can be considered as the linking of two or more hydrocarbon molecules to form one molecule having a longer carbon chain and a higher boiling point. Here again the definition must be narrowed to make it useful, because the tar produced when gas oil is cracked in a conventional cracking coil is the result of polymerization. Polymerization, as practiced intentionally, at the present time is confined to hydrocarbons having four carbon atoms or less to the molecule (butane and lighter), and links them together under conditions which result in the product being predominantly within the gasoline boiling range. The operation can be carried out either catalytically or thermally. The catalytic process operates at relatively high pressures, but at moderate temperatures, and only the unsaturates in the charge react. The thermal process operates at high pressures and high temperatures, but reacts both unsaturates and saturates—due in part, but not entirely, to thermal dehydrogenation taking place in the heating coil as the charge is brought to operating temperature.

Alkylation

If any saturated hydrocarbon molecule is deprived of a hydrogen atom and then united with another hydrocarbon molecule through the bond where the hydrogen atom was removed, alkylation has been accomplished. The broad definition of this term leaves us nowhere, but one of the specific alkylation processes in which interest is at a high pitch at the present time unites **iso**butane (a branched-chain compound) with a butene (unsaturated branched- or straight-chain compound) to produce practically pure **iso**octane. The operation is carried out at low pressure and low temperature, and requires a catalyst. Another example is the process which produces neohexane. In this process ethylene is reacted with **iso**butane to produce a saturated highly-branched-chain six-carbon-atom compound. The neohexane process uses no catalyst.

Desulfurization

In the broad sense, this term is self-defining, but here it will be considered as applying to the removal of sulfur from material within the gasoline boiling range. Chemical desulfurization, using either sulfuric acid or caustic soda, has been practiced for many years; and it should be mentioned, in passing, that strict economic comparisons must be made—the old versus the new—before completely revamping the refinery. There is, however, a definite feeling that chemical desulfurization is on the way out; so, for the purpose of this summary—which is concerned chiefly with the new catalytic processes—the definition will be narrowed to identify processes which decompose the sulfur-hydrocarbon compounds in the gasoline, and evolve the sulfur as hydrogen sulfide or possibly as sulfur dioxide. Desulfurization and dehydrogenation tend to proceed hand in hand, but the interest which is aroused at present is due to knowledge which has permitted the control of the relative rates of these two types of reactions by the use of catalysts. The now proven deleterious effect of sulfur compounds in gasoline on octane number and lead susceptibility has given a dollar impetus to further advances in desulfurization

(Continued on Page 52)

L A U G H T H I S O F F

They were having a big sales meeting at the home office of a local oil company, and the manager was holding forth in somewhat painful style. "Men," he said, "Unless—a—every one of us put our shoulders to the—a—wheel, our gasoline sales are going to slump, and we will find it necessary to—a—put our shoulders to the—a—wheel—in order to increase our —a—gasoline sales". From away over in the corner came a tired voice, "Boss, you'd better quit. You're comin' out of the same hole you went in at."

Gene Hill now comes to bat with the story of the pumper who inquired of his boss, "Can I have the day off to go shopping with my wife?" "Certainly not," says the boss, and the pumper piped happily, "Oh thank you very much."

Gene also tells about a poor chap up in Fellows who suffers terribly from insomnia. It wakes him up every few days.

Insomnia is a terrible thing. We knew one victim whose wife often had to wake him up in the middle of the night to give him his sleeping tablets.

A budding oil worker was soliciting a job from **Wynn Lynch**. "You'd better take me," he said, "There are several other big companies after me." "Which ones?" asked Wynn, and the candidate answered nonchalantly, "The gas company, the water company, and the milk company."

And for merely making a motion at a meeting recently an Oklahoma oil man was shot and killed. He made a motion towards his hip pocket.

Scotty Mair brings us another piece of Caledonian folk-lore this week that sheds further light on the national characteristics of the race. Says Sandy McBagpipes excitedly to his wife and family, "Here's Dugald McPherson coming up tae the hoose for supper. Hurry, noo, everybody oot on the porch wi, a toothpick."

Scotty, by the way, has always claimed it was a Glasgow magazine that started the short short story.

And when **Tom Taggart** called up his buddy last Sunday to inquire if he was going to play golf or go to church, he replied, "I don't know yet, I'm still wrestling with my conscience."

A conscience being something that a man develops when he is too old to misbehave.

Jim Roggie interrupts at this juncture to spin an unbelievable yarn that we repeat against our better judgment. It seems that a Long Beach oil man went back east on a trip recently, and while visiting the old home town attended the funeral of a well known local character. At the conclusion of the service the officiating parson, asked if anyone would like to say a word about the deceased. There was no response, so our Long Beach friend announced, "Well, if nobody wants to say a word about the dear departed I'd like to say a few words for California."

And, accused of exaggerating, another Pacific Coast booster expostulated, "Heck, we Californians have to exaggerate in order to tell the truth."

At that he would probably do better than some of our native products. After watching the main speaker at a recent luncheon painfully reading a prepared speech, **John Sweet** remarked, "He reminds me of a crow in a potato patch —two dabs and a look up."

In fact about the only words that ever create a pleasant impression in this country are the well known trio, "Enclosed find check."

Which recalls the indignant traveler who sputtered to the baggage man, "Nice fix of a station when a suitcase can't find a train. How do you think its going to catch me is all I hope."

That, fortunately, brings us to the end of another exasperation series of inanities. Remember, it's bad luck to have a black cat follow you, especially if you are a mouse.

And according to **Frick Gibbs** most of these so-called bird dogs won't look at a bird until it has been cooked.

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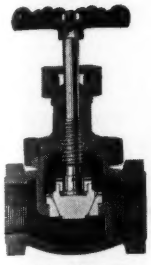

Fig. 1857-P
150 lb. S.P. Plug Type
All-Iron "Ferrenewo"

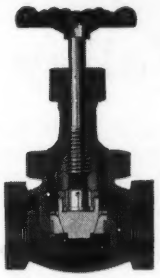

Fig. 16-P
300 lb. S.P. Plug Type
Bronze "Renewo"

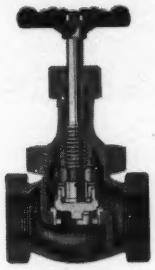

Fig. 1878
350 lb. S.P.
Bronze Globe

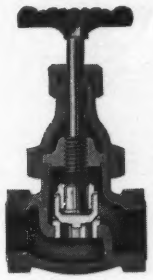

Fig. 1720
600 lb. S.P.
Steel Globe

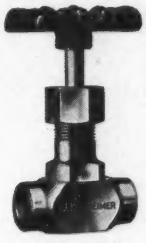

Fig. 1730
3000 lb. W.O.G.
Steel Needle Valve

Fig. 2125
125 lb. S.P.
Double Wedge Disc
Bronze Gate

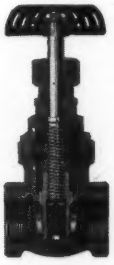

Fig. 2129
125 lb. S.P.
Single Wedge Disc
Bronze Gate

Fig. 1640
150 lb. S.P.
Iron Body
"King-clip" Gate

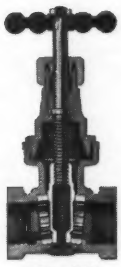

Fig. 768
200 lb. S.P.
Single Wedge Disc
Bronze Gate

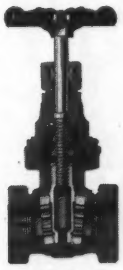

Fig. 1881
350 lb. S.P.
Single Wedge Disc
Bronze Gate

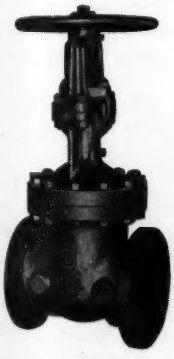

Fig. 1938-D2
300 lb. S.P.
Steel Gate

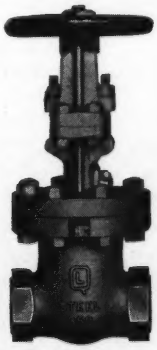

Fig. 1869-B6
350 lb. S.P.
Steel Gate

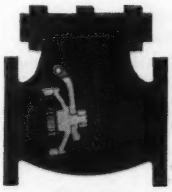

Fig. 1790
125 lb. S.P.
Iron Body Swing Check

Fig. 1880
350 lb. S.P.
Bronze Regrinding
Swing Check

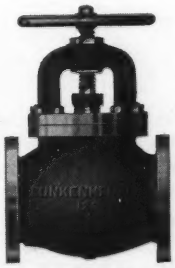

Fig. 1123
125 lb. S.P.
Iron Body Globe

Fig. 1430
125 lb. S.P.
Iron Body Gate

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Field Development

San Joaquin Valley

General Pet. Completes Greeley Extension Well

Bottomed at 11,510 ft. in oil sand and with 180 ft. of zone open, General Petroleum Corp.'s Sullivan No. 1 was completed flowing 1469 bbls. in 23½ hours through a 24/64 in. bean. Gravity of the oil was given as 39.3 and cut was only 3.0%. Gas accompanied the flow at a 1,850,000 cu. ft. rate.

Located near the east quarter corner of sec. 12,29-25, a little more than a mile northwest of Greeley production, the well has definitely proved the structure thought to be directly connected to the Greeley field. General Petroleum is rigging up Farrand No. 1 one location northwest of the current completion.

Sole driller on the structure is Standard Oil Co.'s KCL No. 12-5. Located 2000 ft. southeast of the strike in sec. 7, 29-26, the well was last reported bottomed in oil sand at 11,295 ft. Top of the Rio Bravo oil sand was given as 11,254 ft. which places it 66 ft. higher on structure than the General Petroleum well. The Standard well is standing with a 7 in. string cemented at 11,243 ft. Standard has erected rig for a second well in the section to be known as KCL No. 12-7.

Wilshire Annex Suspends Outpost

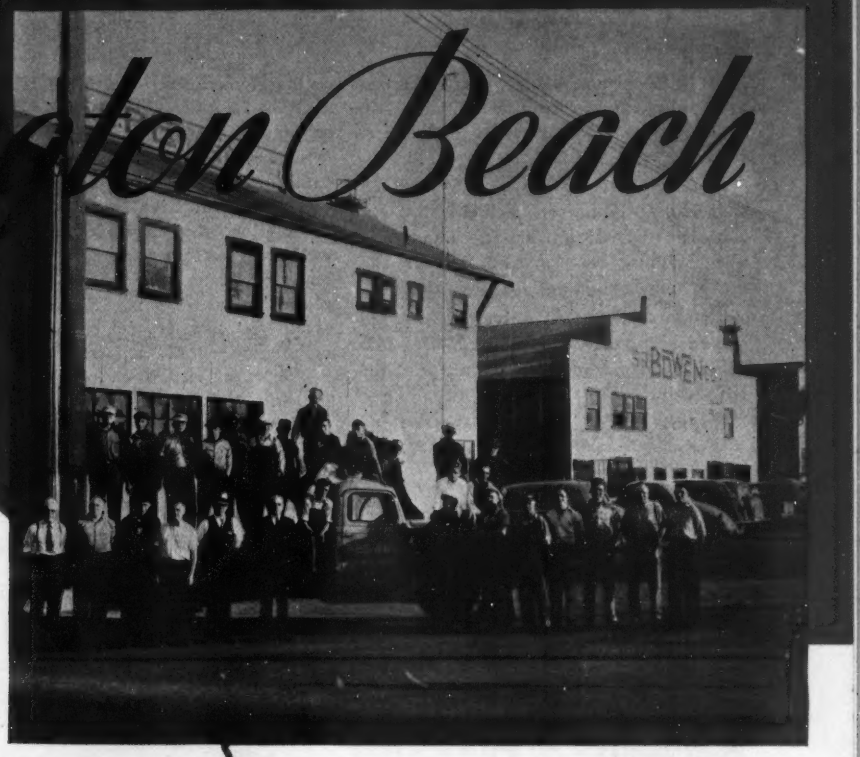
Failing to flow after long and continuous swabbing, Wilshire Annex Oil Co.'s well No. 64-30B, southerly outpost of the Coalinga northeast area, has been indefinitely suspended. Recovery from swabbing the 8383 ft. hole was hot fresh water with traces of oil and gas. Due to the thinness of the oil zone and the lack of gas pressure it is presumed to be on the extreme southerly limits of the shoreline deposited oil sands. The company has made location for well No. 62-30B near the north quarter corner of the section, which may prove to be sufficiently up structure for commercial production.

In the main body of the field Amerada Petroleum Corp., discoverers of the field, are drilling S.P.L. No. 3-17 at

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
Coalinga	Coalinga Pacific Oil Co., P.S.A.	7	6, 21-15		Location
	Lewis, C. H.	1	18, 21-15	65	Drilling
	Rylatt, Harry E., Kipling	3	26, 20-14	2010	Idle
	Wilshire Annex Oil Co.	64-30B	30, 19-16	8383	Suspended
Gatos Creek	Gatos Creek Oil Co.	1	19, 19-13	450	Drilling
	Kern County				
Antelope	Par Petroleum Co.	1	32, 25-17	3032	Idle
Buena Vista	Gen. Pet. Corp., B.V.A.	1	1, 32-24	10607	Drilling
	Richfield Oil Corp., B.V.A.	81-36	36, 31-25	10396	Drilling
	Shell Oil Co., B.V.A.	45-9	9, 32-25	9886	Reaming
Buttonwillow	Union Oil Co., Bowerbank	4-23	23, 29-24	10737	Drilling
Devil's Den	Herzog, Raymond D.	1	27, 25-18	710	Cleaning out
	The Texas Co., Beer	1	6, 26-19	3491	Abandoned
Edison	El Tejon Oil & Ref. Corp., Douglas	1	32, 29-29	3007	Drilling
	O'Rielly, Francis, Edison-Land	2	5, 30-29	4103	Testing
Fruitvale	Richfield Oil Corp., KCL	83-29	29, 29-27	4400	Testing
Greeley	General Pet. Corp., Farrand	1	12, 29-25		Rigging up
	General Pet. Corp., Sullivan	1	12, 29-25	11510	Completed
	Standard Oil Co., KCL	12-5	7. 29-26	11295	Drilling
	Standard Oil Co., KCL	12-7	7, 29-26		Rig
Kern Front	Davis Petroleum Co.	1	13, 28-27		Rig
Kern River	Sleeper Ridge Oil Co.	1	15, 29-28	1765	Idle
McKittrick	Burt & Taylor, Taylor	1	30, 30-22	1047	Idle
	Fairfield, F. E., Williams	2	2, 30-21	1530	Idle
	Fairfield, F. E., Ninkovitch	1	4, 30-21	410	Drilling
	Trico Oil & Gas Co., Westco	2	34, 30-22		Rig
Mt. Poso	G. & V. Oils., Ltd.	1A	35, 26-28	980	Abandoned
	The Caminol Co., Poso	1-18	24, 26-27	2080	Drilling
Panorama Hills	Burrhus, V. E.	2	31, 31-22		Grade
Richgrove	Crusaders Pet. Corp., Quinn	1	9, 25-27	2791	Drilling
	Dilamar Oil Corp., Quinn	3	15, 25-27	2902	Idle
San Emigdio	Continental Oil Co.	KCL F-1	5, 10-21	9227	Redrilling
	Shell Oil Co.	KCL 2A 52-13	13, 11-22	11996	Drilling
	Shell Oil Co., Pleito	A-37-25	25, 11-21	4187	Abandoned
Shale Hills	Gamble & Oliver, Abbott	1	7, 27-19	1210	Drilling
	The Texas Co., McD-Theta	1	12, 28-19		Rig
Strand	Continental Oil Co.	KCL D-2	14, 30-36	14051	Redrilling
	Kings County				
Reef Ridge	Chuka Oil Co.	2A	10, 23-16	185	Drilling
Strattford	P. W. Burnham & Assoc., Bartells	1	23, 20-20		Rig
	Tulare County				
Pixley	Compass Oil Co.	1	8, 23-26	3745	Drilling
	Trico Oil & Gas Co., Tulare Farms	1	27, 24-23	2470	Testing

Huntington Beach



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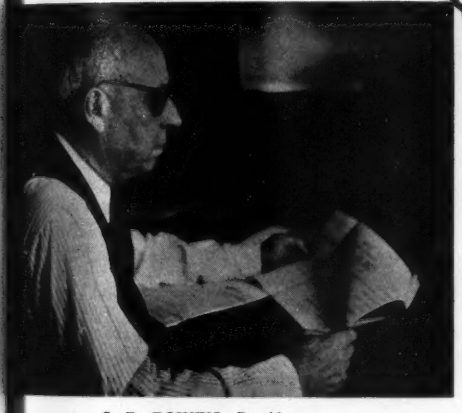

S. R. BOWEN, *President*

S. R. Bowen first started in the fishing tool business at Coalinga in 1910. But when Huntington Beach became the hub of the state's oil industry a few years later, Bowen relocated his organization where it could render the greatest possible service. So in 1921 the main office and plant of the S. R. Bowen Company was established at Huntington Beach, and since that time this organization has grown to be the **largest and most complete fishing tool service company in California!**

The first plant and store was located on a two-acre site right in the center of the activity. In 1921, the personnel consisted of S. R. Bowen, bookkeeper, credit manager and one-man office force; Jack Wilcox, the only field man; S. Siracusa, foreman; Louie Edwards, Walt Bowen and three machinists. One of the first acts of the new organization was to set up its famous night and day ce—so several members of the company lived in rooms over the manufacturing plant to give California operators fast 24-hour ce right from the start!

STATEWIDE SERVICE

But a far different picture confronts the oil man who calls at Bowen's Huntington Beach plant today. For here is a large ern organization, manufacturing the tools and acting as headquarters for the five other Bowen Service Branches located ughout active California fields. S. R. Bowen, president, has led in building his company to its high place in California's oil stry. Other members of the original force, too, are active in the company's affairs, and have helped in establishing the Bowen pany as the leader in its field.

And Bowen has definitely proved its leadership through outstanding performance. Bowen Tools have demonstrated their depend-y and economy on many of the toughest fishing jobs . . . Bowen Service is fast, accurate—always ready 24 hours a day . . . and ix Bowen Stores are equipped with tools, rolling stock and manpower to meet your every fishing tool need.

So next time you're in need of a fishing tool—**call Bowen.** Every Bowen Service Store maintains the most dependable and ent fishing tool service, day and night!

*Bowen has—More Stores . . . More Service Men . . . More Tools . . . More Rolling Stock—than any other fishing tool company alifornia!

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7984 ft. in brown shale. Amerada has also poured foundation for Ewing No. 22-20 near the northwest corner of sec. 20,19-16.

Bandini Petroleum Co. has spudded well No. 46-18 in sec. 18,19-16 and was last reported below 2800 ft. Bandini is also building rig for 51-30B near the north quarter corner of sec. 30,19-16.

Standard Oil Co. operating on fee owned section 19, is drilling No. 51-19B below 7116 ft. and is building rig for No. 62-19B.

Union Oil Co. is running two strings on its Cook lease. No. 57-18 is in hard shale at 7487 ft. while Cook No. 75-18 is in sand and shale at 5406 ft.

Superior Oil Co.'s Husong No. 1, located near the east quarter corner of sec. 18,19-16, is apparently to be the next completion. At the last report the well was bottomed at 8172 ft. in Gatchell oil sand, the top of which was picked up at 7990 ft. Since the water string is already cemented in place, completion should not be long delayed. Superior is preparing to build rig for Husong No. 2 near the center of the section.

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There's a FLUPACO Pump for every condition. For example, the FLUPACO Groove Seal "Producer," illustrated at left, is an insert pump offering the greatest economy in pumping stripper wells and wells of medium depth and volume. It provides the largest possible cross-sectional displacement area in this type of pump and is unusually simple in construction—which means *low maintenance costs.*

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Two Drill At Paloma

At the Paloma Field, discovered in August of this year by a joint test of Western Gulf Oil Co. and The Texas Co., two strings are working toward the Stevens pay zone. Western Gulf's KCL No. A-74-3, located in the discovery quarter of sec. 3,32-26, was last reported in hard gray shale at 8951 ft. A point which checks in every detail with the discovery well KCL No. A-54-3, in which the oil zone was found at 10,013 ft.

Ohio Oil Co.'s KCL No. B-2-43-3, also in sec. 3,32-26, last reported fishing drill pipe with bottom at 7394 ft.

Union Completes Rio Bravo Well

Union Oil Co. has complete Kernco No. 41-34 flowing 1133 bbls. daily. Located well on top of the structure, near the north quarter corner of sec. 34,28-25, the well was brought in through one 17/64 in. bean and one 11/64 in. bean. Gravity of the oil was tested at 38.5 and cut slightly more than 2%. Gas accompanying the flow was metered at 1,507,000 cu. ft. daily. Union is rigging up Nos. 21-34 and 52-34 in the same section.

Superior Oil Co. recently completed the most northwesterly well in the field when Weber No. 1 came in flowing a 3500 bbl. rate of clean 39.7 gravity oil through a 20/64 in. bean. Meters showed 3,200,000 cu. ft. of gas during the period.

Superior's Smith No. 1, one location south of the Union completion, is standing with water string cemented at 11,230 ft., at which point the Rio Bravo oil sand was encountered. Bottom of the hole is given at 11,247 ft. in oil sand.

Superior is grading location for Burner No. 2 near the south quarter corner of sec. 27,28-25, and is preparing to spud Fink No. 2, also near the south quarter corner of the section.

Standard Drilling Wasco Deep Hole

Lone driller in the world's deepest producing field, is Standard Oil Co.'s Mushrush No. 3. Located near the center of sec. 7,27-24 in the Wasco field, the well was last reported at 8270 ft. in blue shale. The well is drilling as an offset to Geo. F. Getty's recently completed Janssen No. 1 which found production in the A-2 sand below 13,089 ft.

Superior Oil Co. has made a location for Meyer No. 1 also as an offset to the Getty well in section 7, and Continental Oil Co. has poured foundation for KCL No. A-5, near the southwest quarter of sec. 8,27-24, in the main body of the small field.

62-13C Apparently Misses Gatchell Sand

Standard Oil Co.'s well No. 62-13C, located near the center of the northeast quarter of sec. 13,20-15 in the Coalinga Eocene Pool, was reported drilling in siltstone at 7251 ft. Correlated from sea level with the base of the oil sand in Standard's 73-13C, one location southeast, the well is already 159 ft. below the bottom of the productive level in this edge of the field. Apparently determined to find the base of the siltstone, the company is reported to be drilling ahead.

Pacific Oil and Gas Acquires New Producer

Purchase of De Koch & Wales No. 1 well in the Fruitvale field, on Bakersfield's outskirts, increases to four the producers of Pacific Oil and Gas Development Corporation in that field. The well, located in sec. 26,29-27, is being reconditioned to increase its yield. Other wells of the company in the Fruitvale field are Nos. 1, 2, and 3 on the Guasti lease in sec. 14,29-27.

The company is also active on the west side, having bought in fee 640 acres in Township 29-22 and 560 acres in Township 29-33. The new property lies in the axial trend-line with the Lost Hills, Elk Hills, Cole's Levee-Western, Paloma and Wheeler Ridge fields. A drilling test of part of it is planned by the company itself, and the 560 acres in 29-23 are under lease to Standard Oil Company of California.

Richgrove Test Again Active

Crusaders Petroleum Corp., located in sec. 9,25-27, 10 miles east of the town of Delano, is drilling Quinn No. 1 at 2785 ft. in hard gray shale. Dilamar Oil Corp.'s Quinn 3, located in section 15 of the area, is idle at 2902 ft.

San Emigdio Well Fails To Flow on Formation Test

Continental Oil Co.'s KCL No. F-1, located in the hills south of the San Emigdio plains in sec. 5,10-21, failed to flow on a test from 9225. With drillable liner in place and tubing run to 8736 ft., the well swabbed gas-cut mud to 8300 ft. Operators are at present milling up the liner to deepen.

Shell Oil Co. has abandoned Pleito No. A-37-25 at 4187 ft. Located in sec. 25, 11-21, on the plains at the base of Wheeler Ridge, the test was bottomed in reddish and green brown sand and clay. Shell Oil Co.'s other San Emigdio try, KCL No. 2A-52-13, was last reported at 11,996 ft. in hard shale. This well, located in sec. 13,11-22 has reported no showings.

Strand Deep Test Fishing Drill Pipe

Continental Oil Co.'s KCL No. D-2, Strand area wildcat and third deepest drilled hole in the world, is fishing drill pipe at 5232 ft. With bottom at 14,051 ft. the hole was plugged back to 11,802 ft. where a short drillable liner was run for a test of Olcese showings below 11,600 ft. While cleaning out for the test the drill pipe stuck and efforts to free it were unavailing. While the Olcese is not ordinarily expected to be especially good, the operators claim that electric log showings of the zone were quite promising.

Richfield Tests Fruitvale Outpost

Richfield Oil Corp.'s westerly outpost at Fruitvale, KCL No. 83-29, recovered 260 ft. of 25 gravity oil with no water from a test of the Kernco sand. The oil zone was encountered at 4380 ft. and only 20 ft. of zone had been taken at the time of the test. The well is now standing with a water string cemented over the pay horizon.

Located a half mile southwest of production, in an area apparently blocked off the main body of the field, the recovery of oil indicates that the company has opened up another fault accumulation.

G & V Abandon Mt. Poso "Cat"

G & V Oils, Ltd., has abandoned Hill No. 1A. Located in the hills on sec. 35, 26-28, two miles southeast of the Dominion Pool, the well was bottomed at 980 ft. in green clay.

On the east side of the pool, The Caminol Co. is drilling Poso No. 1-18 near the east quarter corner of sec. 24,26-27. The well, which is testing an undrilled area, was last reported in Jewett silt at 2021 ft.

Jergins Rigging Up Mendota Area Test

Drilling in sec. 29,14-13, on the northeasterly flank of a long suspected oil bearing structure, Jergins Oil Co. is below 900 ft. in Cheney Ranch No. 1. Location for the try is approximately 12 miles southwest of Mendota and 24 miles northwest of Coalinga.

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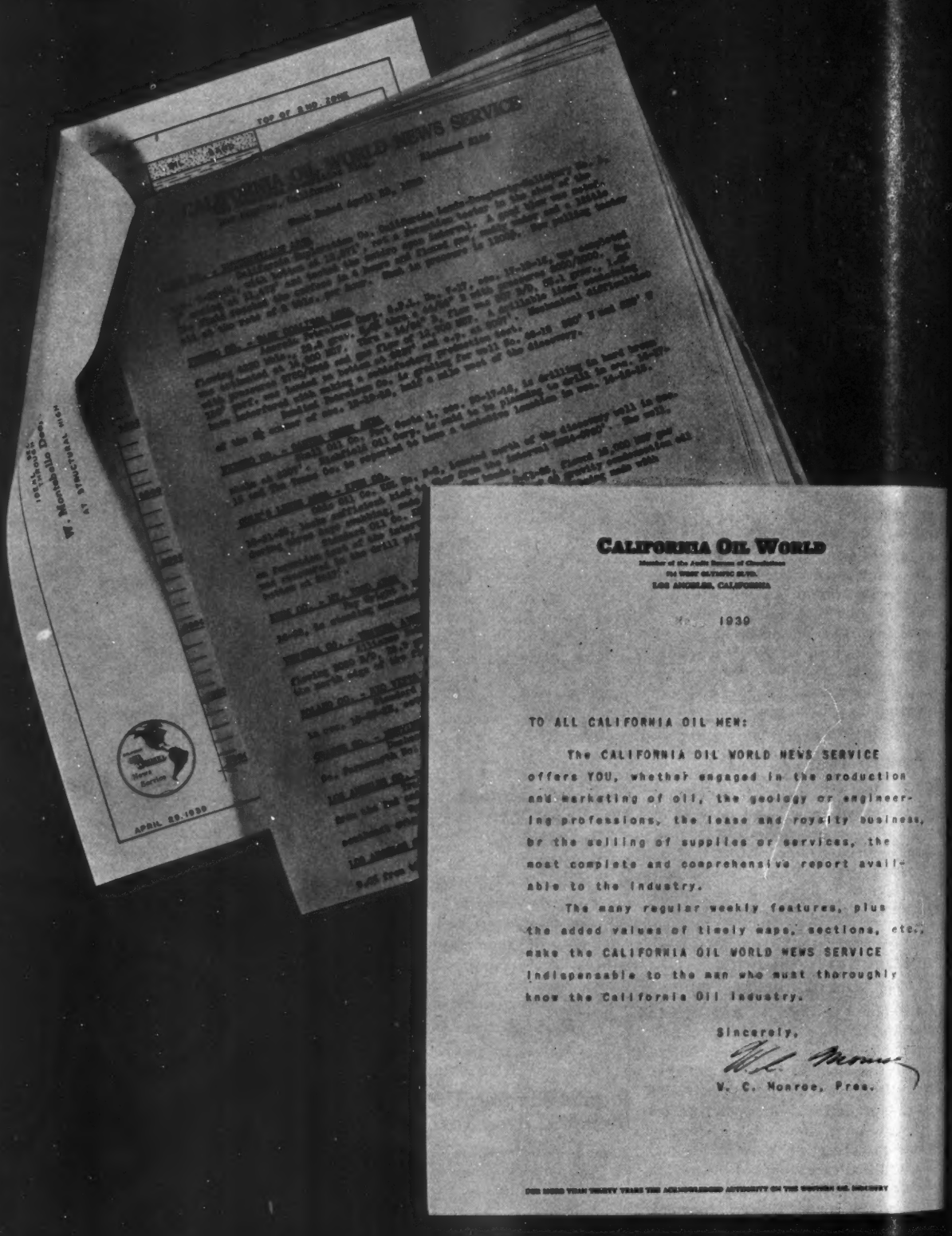
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APRIL 29, 1939
CALIFORNIA OIL WORLD
1939
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The many regular weekly features, plus the added values of timely maps, sections, etc., make the CALIFORNIA OIL WORLD NEWS SERVICE indispensable to the man who must thoroughly know the California Oil Industry.
Sincerely,
V. C. Monroe, Pres.

C. H. Lewis Drilling Coalinga Wildcat

Most southerly test of the Coalinga Area in recent years, is C. H. Lewis' newly spudded well No. 1. Located near the west quarter corner of sec. 18, 21-15, south of the West Side productive area, the try is near a shallow hole drilled some years ago by the Manchester Oil Co.

Two miles to the north, at the southerly edge of West Side Coalinga production, in sec. 6,21-15, Coalinga Pacific Oil Co. has announced location for Pacific States Annex No. 7.

All other West Side development is, at the moment, inactive.

Hopes Dim For B. V. Lake Trys

Discovery of the Stevens zone much lower than anticipated, and showing little promise in two of the current tries, does little to bolster the fading hopes for deep zone oil production in the Buena Vista Lake area.

General Petroleum Corp.'s BVA No. 1, located at the northeasterly base of the Buena Vista Hills in sec. 1, 32-24, is believed to have entered the much sought Stevens zone at 10,560 ft. Bottom was last reported at 10,614 ft. with the sand tightly packed in thin streaks between layers of Cherty shale. No sand encountered to date has shown signs of affording a reservoir for oil accumulation.

Across the lake, in sec. 36,31-25, Richfield Oil Corp. also encountered the Stevens zone in BVA No. 81-36. Situated much nearer the Stevens zone production found at Palomar near 10,000 ft., the Richfield try located the top of the poor quality sand at 10,310 ft. Richfield has the advantage in this well, since commercial gas production was established in a test of the Etchegoin near 5500 ft.

Sole ray of hope is the fact that Shell Oil Co.'s BVA No. 45-9, located at the south edge of the lake in sec. 9,32-25, was last reported at 9896 ft. in hard shale and Chert. Presence of Chert, which usually overlays the Stevens zone ,at a point some 500 ft. higher than in the Richfield driller, could indicate that the Stevens sand may be found higher and of better quality in this try.

Union Nears Goal In Buttonwillow Try

Union Oil Co.'s deep test of the Buttonwillow area, Bowerbank No. 4-23, was last reported at 10,737 ft. in hard shale and Chert. Located in sec. 23, 29-24, 4 miles southeast of a point where the Stevens zone is known to exist the well should soon be in the sand. Knowledge of the pay zone in this area is predicted on a 12,989 ft. hole drilled by the California Exploration Co. which found the oil bearing sands present but not commercially productive. The well was adequately tested and abandoned when it became apparent that at that point permeability was insufficient.

W. M. Thompson Taken by Death

Death on Nov. 20 claimed Walter Miller Thompson, president of the Reliance Regulator Corp. at his home, 800 Holladay Road, Pasadena, following a heart attack. He was 76 years old.

Mr. Thompson, a native of Dundee, Ill., came to Los Angeles in 1911. He entered business here in 1917.

He leaves his widow, Mrs. Mary B. Thompson, a son, Arthur C. Thompson, associated with the same firm, and a daughter, Mrs. Edward F. Swift Jr., of Lake Forest, Ill.

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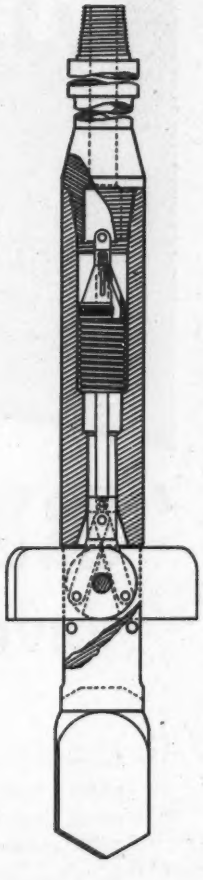

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Standard Oil Company of Louisiana
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Los Angeles Basin

Depth Improves Signal Hill Test

Outlook of Signal Hill's newest deep test is improving with depth, according to R. W. (Rocky) Jerman, president of Dormax Oil Co. At 10,270 ft. the drill passed from hard brown shale into a much softer sandy interval which continued to last reported bottom at 10,400 ft. An electric log, run at 10,325 ft., indicated the bottom 60 ft. of formation to be largely oil sand and drilling will be continued until a change occurs. A string of 7 in. casing is cemented at 9552 ft. and all that remains to be done is choose a final bottom, run a liner and complete.

At present, more than 400 ft. of formation has been opened below a depth comparable with that of De Soto Oil Co. No. 1 which was completed last winter flowing 350 bbls. a day by gas lift. Chief basis for hope of better production in the present test is in the fact that De Soto Oil Co. stopped in the hard, impermeable shale without encountering the softer horizon in which Dormax is now reported.

Of equal importance is Jack Rogers' El Hondo Petroleum Co. No. 1 which is now drilling below 10,125 ft., at the northeast corner of Spring St. and American Ave. This well is expected to set casing soon at approximately 9700 ft. where showings are said to be particularly good.

The third well heading deep is Allied Petroleum Corp.'s No. 34, located across the street from De Soto Oil Co. No. 1. Depth at last report was 3350 ft.

Activity throughout the field as a whole is at its highest point since the crooked hole boom of several years ago, there being a number or redrilling jobs under way as well as new holes being drilled by The Caminol Co., Ltd., J. P. Massey & Associates, A. S. Johnston, and Atlantic Oil Co.

One of the most interesting of the redrill jobs is that undertaken by the veteran, John McKeon. Entering the old Rawco-Decker abandoned well, located on Lemon St., south of Willow, the old water string was fished out below the shoe of the surface casing and a whipstock set to direct the hole to the north. The well will eventually be bottomed beneath the cemetery in the Alamitos zone. Mr. McKeon is planning to drill a 10,000 ft. well, directing it to the same subsurface location, if either of the deep wells now preparing to test is successful.

North of El Hondo's deep test, Chet Yunker is redrilling his Barbara No. 1 to recomplete in the shallow zones. He will, however, drill a new deep well if substantial production is obtained by his neighbor.

Northeast Harbor Well Flows 250 Bbl. Rate

Definitely proving that substantial production may be obtained in the northeasterly portion of the Long Beach Harbor area, Simon Bernstein completed his first well flowing at an initial rate of 250 bbls. a day. Gravity of the oil is over 14 and the cut is said to be less than 5.0%. The well utilizes 310 ft. of shale and oil sand which is open to bottom at 3595 ft. If production stands up, many other operators expect to enter this section of the field.

Another unusually large well was completed by Union Pacific Railroad No. 20 on the Edison property. Bottomed at 4047 ft. and open in three separate zones below 2415 ft., initial yield was at the rate of 7500 bbls. a day. No. E-19 is being completed in the Terminal zones, the Ranger being blanked off.

The northwest end of the Wilmington townlot field appears due for a renewal of activity with the erecting of new derricks by Brookline Oil Co. and Bond Petroleum Co. near the intersection of "L" and Marine Streets. Several other operators have applied for permits in the same area.

Dumm Bros. Petroleum Co. completed Dumm No. 3 at the corner of Santa Fe Ave. and Wilmington Blvd. flowing an estimated 250 bbls. a day from 370 ft. of Ranger zone open to 3505 ft. Equipment was moved to J. M. Jackson Exploration Co.'s Workman No. 1 which is preparing to complete after cementing 8⅝ in. casing at 3153 ft.

Westerly Wells Extend Montebello Production

Completion of The Texas Co.'s Wilcox No. 1 and a favorable formation test in The Caminol Co., Inc.'s Montebello No. 3-17 extended the limits of Montebello

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Athens	Melrose Pet. Co.	1	12, 3-14		Rig
Chatsworth	Fernando Oils. Ltd., Holmes	1	18, 2-16		Grade
Dominguez	R. E. Havenstrite, Operator	1	32, 3-13	6149	Drilling
Inglewood	Vanguard Oil Co., L.A.I.	1	29, 2-14		Rig
Mint Canyon	Redwood Oil Co., Mitchell	2	22, 4-15	525	Idle
Newhall	Mangrum and Page, Lintz	1	4, 3-15	737	Drilling
	Consolidated Pet. Co., Needham	4	13, 3-16	3700	Fishing
	Tamas Oil Co., Perkins	1	11, 3-16	3200	Drilling
Palos Verdes	Rolling Hills Pet.	1	27, 4-14	6540	Idle
Potrero Heights	Owen O Oil Co.	1	36, 1-12		Cellar
Puente	Kelso, F. W., Kelso	1	13, 2-10	2380	Idle
	Stabeck & Assoc.	1	14, 2-10		Rig
Sunland	Casa Grande Oil Co.,Lopez-Lundy	1	1, 2-15	2160	Drilling
West Whittier	West Whittier Oil Co., Pellissier	1	17, 2-11		Location
Whittier	C. W. Partridge, Hillside	1	22, 2-11	1780	Idle
	Partridge, C. W., Whittier Crude	14	22, 2-11	1310	Completed
	Orange County				
Costa Mesa	Thompson, Milton N. Banning	1	9 6-10	900	Drilling
Olive	Morton & Elder	1	17 4-9	628	Pumping water
	San Bernardino				
Carbon Canyon	Carbon Canyon Oil Co.	1	30 2-8	256	Idle
	Hokom John Oil & Gas Co. Ltd. Hokom	1	31 2-8	2941	Idle

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Contra Costa	Tassajara Oil Corp.	1	9 2s-1e	275	Drilling
Merced	Seaboard-TWA-Union Howard	1	6, 8s-11e	6061	Drilling
Monterey	Priest Valley Pet. Co., Greve	1	22, 20s-12e	1395	Drilling
Sacramento	The Texas Co., Welsh	1	5, 3n-3e	4136	Drilling
San Benito	Consolidated Pet. Co.	1	11, 17s-11e	2007	Idle
Solano	Richfield Oil Corp., Potrero Hills	2	5, 4n-1w		Location
Sutter	Buttes Oilfields, Inc., McPherrin	6	1, 15n-1e	6055	Fishing

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deep production west to the intersection of Wilcox Ave. and Beverly Blvd.

Wilcox No. 1 was bottomed at 7687 ft. and with a 5½ in. liner perforated 7510-7595 ft. and 7625-7667 ft., was swabbed in flowing 1150 bbls. of 35 gravity clean oil and 2,000,000 cu. ft. of gas. With the bean reduced to 15/64 in., production is 440 bbls. of 36.5 gravity oil and 525,000 cu. ft. of gas. Casing has built up to 1700 lbs.

Reported to be 20 ft. higher structurally than the Texas well, Caminol's No. 3-17, cemented 7 in. casing at 7480 ft. after drilling to 7637 ft. With hole cleaned out 30 ft. below the shoe, the well flowed 480 bbls. a day for a 36 hour period. As no water was in the flow, the well will be cleaned out and completed.

Encouraged by success of Texas and Caminol, several other operators are planning to drill in the west end immediately, among them Geo. F. Getty, Inc. and Westmont Petroleum Co. The Texas Co. is drilling Wilcox No. 2, 900 ft. west of No. 1 and is preparing to start No. 3.

At the opposite end of the field, Fullerton Oil Co. encountered difficulty in completing Scott-Arnold No. 2 on the northeast corner of Poplar and Lincoln. With only 55 ft. of the upper Eighth zone open, the well was brought in on the pump but is now flowing 175 bbls. a day by heads. Water content is said to be 5.0%.

Half a block west of Poplar and north of Lincoln, Crail Bros. finished their No. 2 flowing 525 bbls. a day. Open to bottom at 7635 ft. was 165 ft. of shale and oil sand.

R. R. Bush Oil Co., one of the most active operators in the field, completed two typically fine wells in Zanetti No. 1 and Mihlford No. 1.

Fourteen completions during the last fortnight reduced the number of drillers from 40 to 30 but a sufficient number of new projects are preparing to drill to maintain the development rate for the time being. Meanwhile, the Eighth zone is still good enough to keep the boys from looking for a Ninth.

South Rosecrans Well Is 840 Bbl. Producer

After masquerading for weeks as a 250 bbl. well, Southern California Petroleum Corp.'s Slabaugh No. 1 has been revealed as having a potential of 1000 bbls. and as having actually produced 840 bbls. a day. Located on Compton Blvd. in the South Rosecrans area and directly across the street from Dr. Averill's 100 bbl. No. 1, the Southern California well fooled the industry since its completion Oct. 7th. Now beaned back to its allowable, production is 210 bbls. a day of 32 gravity clean oil from 170 ft. of formation open to bottom at 7641 ft. Rumor has it that a fault separates this one from its neighbor.

Seeking the same kind of "small" well, Thos. Kelly & Sons are drilling their No. 1 at the corner of Compton Blvd. and Ball road.

The completion of Barnsdall-Wilshire's Darling Comm. No. 1 flowing 400 bbls. of oil and 275 bbls. of water caused Dr. Averill to deepen his abandoned No. 3 located south of Redondo Blvd. Cores below 8080 ft. to bottom at 8400 ft. showed a high percentage of oil sand and casing has been cemented for a production test.

The joint operators, Barnsdall Oil Co. and Wilshire Oil Co., are drilling Santa Fe Corp. No. 1 near 7100 ft. and report the project is higher structurally than Darling No. 1.

Because of late favorable developments, Apex Petroleum Co. is expected to start soon on Hatfield No. 1 near Averill's No. 3.

Two To Explore North Athens Area

Two wells are preparing to explore for new production near the northwest tip of the Athens field. Half a block west of Figueroa St. on 124th St., Thorley Oil Co. has built a steel derrick with the announced intention of drilling to 7600 ft. to tap the sand found in E. J. Miley's record depth well of 1926. No other well in the Athens area has gone below that point.

At the intersection of Berendo Ave. and 123rd St., Melrose Petroleum Co. is ready to install machinery for its proposed wildcat. Located near the Inglewood fault, the well has a reasonable chance for production.

Petromont Completes 2nd Five Points Well

Petromont Oil Co. placed its second Huntington Beach Five Points well on the pump with initial gauges indicating settled production would approximate 100 bbls. a day. Burton No. 2, as the well is known, bottomed at 4470 ft. and utilizes 60 ft. of formation.

A better than average yield was attained by Southwest Development Co.'s latest completion, State No. 21. With 850 ft. open to 5000 ft., the well was pumped in, but built up to nearly 600 bbls. a day, clean.

Most important to the field's future is South Basin Oil Co. No. 93 which is being rigged up to deepen. As "Deep

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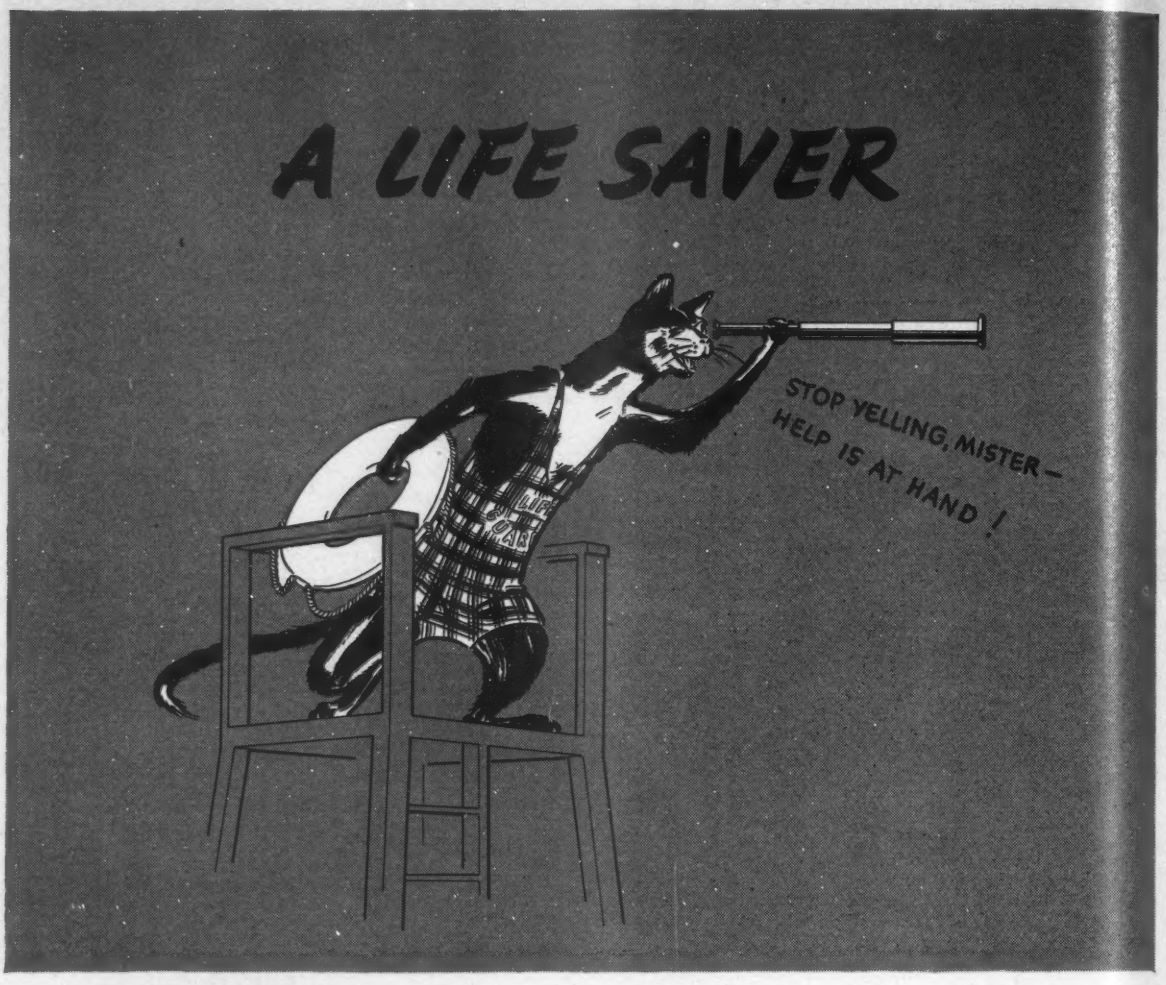

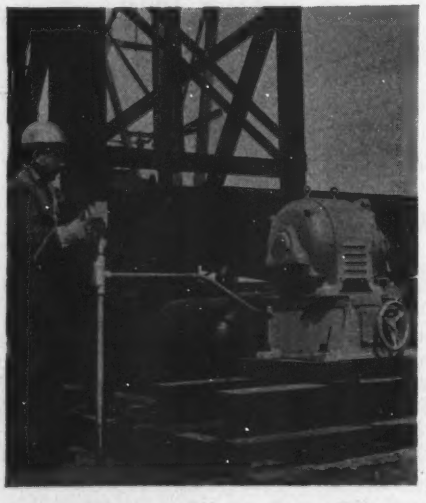

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11-39

Hole" Ed Kasey, who has drilled two 10,000 ft. wells at Signal Hill is superintendent, it is surmised that No. 93 will explore for deep production.

Across the street from Huntington Beach High School, Ray Price is deepening Venture No. 1 below 3500 ft.

Continued tests of H & T Oil Co.'s Farnsworth No. 4, located on the flats east of the main field, indicate chances of obtaining production in the old 3650 ft. zone are remote. As a small quantity of oil was recovered, however, the hole is being cleaned out for another pumping trial.

Alabama Street Oil Co. is preparing to complete H. B. No. 1 after drilling to 3111 ft. and plugging back to the 2750 ft. zone. A 6⅝ in. water string has been cemented at 2600 ft.

Union Hole No. 21 Flows 500 Bbls. Daily

Union Oil Co. obtained excellent production in the completion of Hole No. 21 in the center of the old East Coyote field. With bottom at 4673 ft. and 7 in. casing cemented at 3800 ft., a perforated liner was run and the well brought in flowing over 500 bbls. a day of 24 gravity oil. In the westerly portion of the field, the company is preparing to drill Hole No. 22.

Bartholomae Oil Corp., original developers of the west extension, are deepening Stern No. 1 at 4850 ft.

Adjoining Sonwell's 100 bbl. pumper on the north flank of the structure, California National Oil Co. is planning to drill a new well. The company and its affiliates control much acreage in the vicinity.

Sunland Wildcat Bails Trace of Oil

On a bailing test of 8⅝ in. casing cemented at 2120 ft., Casa Grande Oil Co. obtained only a trace of oil, though the fluid levels was lowered to 1435 ft. A 20 ft. interval was open during the test. Still in gray oil stained sand, the well is being deepened below 2160 ft. Location of the project is sec. 1,2n-15w, near Sunland.

Asphalt Petroleum To Drill Seal Beach

Seeking the prolific 4900 ft. producing zone recently reopened by the Hellman interests at the east end of the Seal Beach field, Asphalt Petroleum Co. is preparing to start work on a portion of the Bryant property. Headed by Neal Anderson, the company's made up of prominent oil men.

West Dominguez Wells Reach Interesting Stage

Larrondi No. 1, Russ Havenstrite's attempt to extend Dominguez production west of Avalon Blvd., and Union Oil Co.'s offset to the east, are approaching interesting stages. Off to a head start, the Havenstrite well is coring for possible oil sands at 6260 ft. while Callender 73 is drilling rapidly below 4000 ft. Union's other west end project, Callender No. 74, is coring at 6800 ft. and if successful, will extend the field one location to the northwest.

Resins Plastics From Petroleum

The discovery that base materials for synthetic resins and plastics are available from petroleum in large volume and at low cost will stimulate production in new and promising chemical fields, it is believed.

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Ventura North Side Discovery Deepened

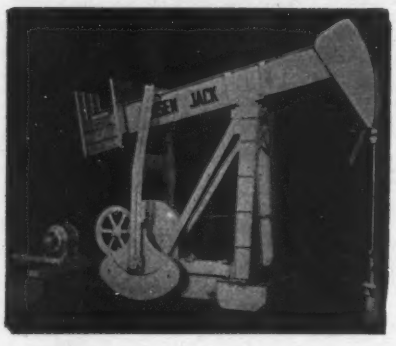
Deepened 78 ft. to 7555 ft., California Alliance Petroleum Corp.'s Hartman Ranch No. 1 re-established itself as the discoverer of an important new north side zone by flowing a 480 bbl. a day rate of 32 gravity clean oil through a 32/64 in. bean. With the orifice reduced to 24/64 in., present production is 310 bbls. a day with 275 lbs. flow pressure and 900 lbs. casing pressure. Gas yield is estimated at 100,000 cu. ft. Open below the shoe of the water string is 218 ft. of oil bearing sands and shales. Preparations are being made to drill Hartman Ranch No. 2 approximately 500 ft. to the northwest.

In the northeasterly section of the field, Lloyd Corp.'s No. 3 is plugging bottom from 10,283 ft. to 9975 ft. after a formation test showed the lower horizons to be wet. Well No. 4 is standing with 7 in. casing cemented at 9550 ft. and No. 5 is being started 700 ft. east of No. 3.

British American Oil Producing Co., only other independent operator active in the field, is drilling Hartman No. 9 at 5225 ft. It is the company's third venture on the Bolsa Chica Oil Corp.'s property.

General Petroleum Corp. redrilled Barnard No. 16 to 8380 ft., where with perforations open at intervals below 7850 ft. it was recompleted flowing 500 bbls. cutting 15%.

Shell Oil Co. and Tide Water Associated Oil Co., own the bulk of the active wells, the former at present drilling five and the latter company drilling eight.



Shell Oil Enters San Marcos Area

Taking up the search where Richfield Oil Corp. recently left off, Shell Oil Co. is drilling an exploratory well near San Marcos in Santa Barbara county. Located in sec. 13,6-30, the project which is called Barrett No. 1, is about two miles northwest of the three wells drilled and abandoned by Richfield. With 9⅝ in. surface casing cemented at 100 ft., it is planned to carry a "slim hole" to about 3000 ft.

Schaeffer Spuds Near Moorpark

Renewing interest in the Moorpark section of Ventura county, Schaeffer & Associates have set up a portable rig and are drilling at a shallow level in sec. 30,3-19. Location of the well is about a mile and a half north of Gabbert No. 1, drilled by Standard Oil Co. to 4869 ft. several years ago.

South Mountain Well Cores Fair Oil Sand

Fair oil sand was reported cored by Harry Rilling's Camden Oil Co. No. 1 in sec. 13,3-21 in the South Mountain field. Now drilling below 2500 ft., best showings are said to be in the Sespe between 1550 and 1700 ft. A formation test at 1500 ft. recovered only a little mud.

Albatross Oil Co. is planning to drill Schiefferle No. 1 for which derrick is up in sec. 17,3-20.

Our Catalog is filed in the COMPOSITE CATALOG

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Coffeyville, Kansas, U. S. A.

COASTAL COUNTIES WILDCATS
Santa Barbara County

Area	Well	No.	Section	Depth	Status
Carpinteria	Sunset Oil Co.	1	32, 4-25	3413	Idle
Cuyama	Hearte, O. K.	1	11, 9-25	2000	Idle
Goleta	Gen. Pet. Corp., More	5	22, 4-28		Rigging up
Lompoc	Sun-Bell Drilling Co.	1	28, 8-34	2982	Idle
Los Olivos	United Western Oil Co.	1	15, 7-30	3935	Rep. equip.
San Marcos	Shell Oil Co., Barrett	1	13, 6-30	107	Drilling
	San Luis Obispo County				
Elk Horn	Calif. Pet. Prod., Irons	1	19, 10-24	2500	Idle
	Newton, S. M., Stafford	1	18, 31-21	5075	Redrilling
	Newton, S. M., Well	1	3, 32-21		Grade
	Burrhus, V. E.	1	8, 32-22		Rig
	Burrhus, V. E.	3	27, 32-22		Location
Midway	Foster, Robt., A., McKee	1	2, 32-22	5075	Abandoned
Paso Robles	Epco, Inc.	1	27, 26-13	6157	Idle
	Ventura County				
Conejo	Sulphur Springs Oil Co., Janss	1	33, 2-19		Rig
Moorpark	Schaeffer, et. al.	1	30, 3-19	85	Drilling Portable
Ojai	Argo & Rynning, M & A	1	7, 4-21		Location
	Coronet Oil Co., Coronet	4	17, 4-21	508	Drilling
Santa Susana	K. C. Oil Co., Marr	1	32, 3-17	1014	Idle
Sespe	Nevada-Fortuna Oil Co.	1	13, 4-19		Rig
	Renard Oil Co.	1	6, 4-19	887	Drilling
Shiells Canyon	Galveston Oil Co.	1	5, 3-19	3140	Idle
South Mountain	Albatross Oil Co., Schiefferle	1	17, 3-20		Rig
	Rilling, Harry	1	13, 3-21	2480	Drilling
Tar Creek	Section 20 Oil Co.	1	20, 5-19	4157	Abandoning

Test Fails In Section 20

The production test recently attempted in Section 20 Oil Co.'s Tar Creek wildcat recovered only water with a small quantity of oil and the well is being abandoned. The latest try was to obtain production in the Eocene interval from 3950 ft. to bottom at 4157 ft. Several years were consumed in the drilling of this well which is located in sec. 20,5-19.

Santa Maria Gets Two Large Producers

Two more large wells were completed during the past two weeks in the Santa Maria Valley field. First to go on production was W. R. Gerard's No. 2 located at the west quarter corner of the northwest quarter of sec. 27,10-34, just west of the former hot spot. Over 500 ft. of Miocene was cored above the Franciscan basement which was topped at 4975 ft. and penetrated to 5060 ft. Completed on Armistice Day, initial production was gauged at a 3500 bbl. per day rate of 16 gravity clean oil through a 24/64 in. bean.

Second big well to go on production was Union Oil Co.'s Frank Vicente No. 6 which bottomed in the Franciscan at 5294 ft. and, with 345 ft. open, came in at a rate estimated at 6500 bbls. a day. Location is in the southwest corner of the Frank Vicente property in sec. 21.

Only one well is drilling in the entire field, that being Navy Oil Co.'s Jim O'Donnell No. 1, now below 4500 ft. in depth. The project offsets recent completions in the Paderewski Subdivision.

Conoco Completes San Miguelito Well

Completing Grubb No. 12 in the San Miguelito field at 7413 ft., Continental Oil Co. obtained a flow of 750 bbls. of 29 gravity clean oil and 570,000 cu. ft. of gas through a 48/64 in. orifice. The 5 in. liner included 1125 ft. of perforations below the 7 in. water string cemented at 6005 ft.

Continental is moving equipment to No. 13, while No. 14 is drilling below 5500 ft.

Tassajara Spuds Northern Wildcat

Tassajara Oil Corp. of Oakland spudded in its important test of the Tassajara structure in Contra Costa county, and is drilling near the 500 ft. level, according to advices received from the north.

The California Oil World wishes to correct a misquotation which appeared in a recent issue by Dr. Bruce L. Clark of the University of California. Attributed to Dr. Clark was the statement that Miocene shales are exposed in the Black Hills north and west of the well site, when in reality he said the exposures in the Black Hills are to the east of the well which is located in sec. 9, 2s-1e.

Our apologies to Dr. Clark.

Coronet Drills 2nd Ojai Well

Coronet Oil Co. is drilling its second well in the shallow fields east of Ojai. Now making hole below 600 ft., the new project is located in sec. 17,4-21 and is the No. 4 well on the Capitol Crude lease.

Shiells Recompletion Pumps 130 Bbls. Daily

With an initial production of 130 bbls. a day, Savage Oil Co. recompleted Calumet No. 2 at Shiells Canyon. Drilled many years ago to 2735 ft., the old hole was redrilled and deepened to 2984 ft., where with 396 ft. open, the well was again placed on the pump. Present yield is reported as 75 bbls. of 31 gravity oil with an average cut of 10%.

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Henry A. Ley, National President of the American Association of Petroleum Geologists, left, and A. I. Levorsen, past president, attend the Pacific Coast Section annual meeting.

Two ex-officials still in the midst of things geological are, left to right, Dave Hobson, ex-secretary-treasurer, and Roy M. Barnes, ex-president of A.A.P.G. Both are Continental Oil Co. men.

(Continued from Page 35)

methods for sulfur removal alone. This is a distinct contrast to previous trends of thought, in which the sulfur reduction which accompanied various forms of dehydrogenation was accepted for what it was worth in meeting sulfur specifications of the gasoline—without giving too much thought to control and selectivity.

Isomerization

Inasmuch as saturated hydrocarbons can exist as either straight-or branched-chain compounds, and as the branched-chain compounds in the gasoline boiling range have higher anti-knock qualities than the straight-chain compounds (e. g., isooctane vs. normal heptane, the 100 and 0, respectively, of our anti-knock scale) interest in controlled changing of straight chains to branched chains (isomerization) will increase sharply if practicable methods can be discovered. Isomerization, as now available for our study as an isolated process, is confined to butane and pentane conversion to the corresponding isocompounds; but inasmuch as the extremely high octane-number increase obtained during certain catalytic-dehydrogenation operations on gasoline best can be accounted for by assuming some isomerization to have occurred, it is the opinion in many quarters that catalysts and conditions will be found eventually which will extend isomerization as a controlled process into the broad gasoline boiling range.

Aromatization

For present purposes let us define aromatization as the conversion of saturated hydrocarbons to aromatic hydrocarbons, e. g., conversion of hexane to benzol, heptane to toluol, etc. Processes using catalysts at relatively high temperatures and moderate pressures have such conversions with surprisingly high yields. Aside from the "war-baby" aspect of such processes, their future probably will depend to some extent on present investigations to determine the relative merits and demerits of inclusion of aromatics in fuel for use in high-power aviation engines operating at high altitudes.

Cyclization

This process is the conversion of straight-chain hydrocarbons to ring compounds (cyclics) but without the attendant dehydrogenation which necessarily takes place during the production of aromatics. The development of cyclization as a definitive process is tied in with the remarks previously made about the future of aromatization. The process doubtless will be catalytic, but it is still over the horizon, and cannot enter too seriously into present thinking.

Catalytic Cracking and Reforming

As mentioned previously, cracking involves dehydrogeneration of the type defined as destructive. In the rupturing of the hydrocarbon chains, there are created fragments which are extremely active chemically. In the course of reacting to attain chemical stability, these fragments apparently, to some degree, engage in practically all of the reactions which we have been discussing. The use of a catalyst during cracking has the interesting effect of decreasing the amount of polymerization to tar and at the same time encouraging aromatization and isomerization of the cracked fractions in the gasoline boiling range. As a result, material of high anti-knock value is produced. In catalytic reforming a different effect is sought. Here aromatization and isomerization are encouraged by different operating conditions and catalysts, but every effort is made to supress the chain rupture which would cause excessive conversion of gasoline to gas. In the following discussion, catalytic reforming is classified as dehydrogenation, but merely for convenience, and does not infer that the dehydrogenation phase is considered predominant.

Coking

The operation of coking, whether thermal or catalytic, consists of heat-treating heavy hydrocarbons, usually crude residuum or cracked tar, in order to increase the ultimate yield of gasoline from the crude.

St. Anthony Oil Corp. Rosecrans Drilling Program

Announcement has just been made by the St. Anthony Oil Corporation of plans for a drilling campaign on the company's acreage in the Rosecrans oil field.

The Woodward Brothers are very well and favorably known in the California oil industry. It was in 1922 that John Woodward drilled and brought in the Woodward-Bull 10,000 barrel per day well at Santa Fe Springs. This was followed by successful drilling campaigns in many fields, including Signal Hill, Huntington Beach, and Poso Creek, Kern County fields.

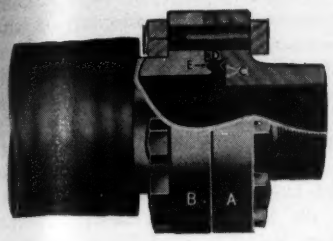
In March of 1938 Hoke Woodward joined his brother John in the formation of the St. Anthony Oil Corporation.

St. Anthony Oil Corp.'s president, John A. Woodward, left, and Secretary-treasurer Hoke Woodward, brothers.

Grizzly Pressure Seal Rotary Hose Announced

A new Grizzly Pressure Seal Rotary Hose, without nipples and with a positive pressure seal coupling built integral with the hose body, has just been announced by E. M. Smith Co., manufacturer, of Los Angeles, Calif.

According to the manufacturer, the hose is designed to withstand higher pressures than any encountered in drilling wells to any depth, without the hazard of leakage or blowouts around the coupling. The coupling is compact, light in weight, and incorporates an entirely new and different method of sealing off the fluid by means of the pressure within the hose. As will be noted in the illustration, seepage of the fluid into the clearance between the coupling flange and adapter at "A" and "B", forces the specially designed terminal of hose body "C" firmly against the solid wall of the adapter at "D" and into the recess in flange "E", thus forming a positive seal at pressures that are practically nil. Assembly of the adapter to coupling flange is steel to steel, with sufficient clearance at "A" and "B" to positively eliminate any possibility of pinching or otherwise damaging the hose. The adapter is made of steel with an extra thick wall, insuring less danger of cutting out and assuring much longer life. Both the adapter and flange are machined to precision fit, securely bolted together, and never require tightening when in service. Full opening throughout the entire length of the hose gives unobstructed flow at all times.



The hose is supplied in two grades—Grizzly Powerflex and Grizzly Cub Red Line. Both are steel armored throughout their entire length, providing ample strength to withstand any pressures without detracting from its extreme flexibility. Integral construction of the coupling with the hose body and its steel armor prevents any possibility of coupling being blown out. Both grades of the hose also are available with Neoprene oil-resisting and abrasion-proof tube, for use when circulating oil. Further details and descriptive Bulletin No. 20-OF may be obtained by addressing the manufacturer at 600-650 South Clarence Street, Los Angeles, Calif. The product is available through leading supply stores.

Parkersburg Appoints New Chief Engineer

Appointment of R. Griffin De La Mater as chief engineer of The Parkersburg Rig & Reel Co., effective Oct. 1, has been announced.

Mr. De La Mater graduated from Rensselaer Polytechnic Institute in 1921 and thereafter served as assistant professor of mechanical engineering at Worcester Polytechnic Institute. Later he engaged in consulting work and in 1929 joined The Parkersburg Rig & Reel Co. as assistant chief engineer.

R. Griffin De La Mater

Chief among his contributions to the oil industry has been the invention of the Hydromatic Brake. It is generally regarded as one of the most important developments of recent years.

Mr. De La Mater succeeds Mr. Wm. Schwemlein who has been promoted to executive duties.

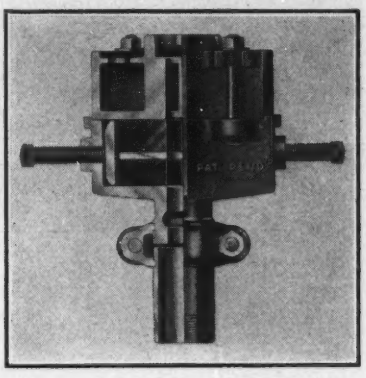
Victor Equipment Issues Preview of Welding Catalog

To show the wide operating range, utility and flexibility of the standard Victor welding torch, Victor Equipment Co. has issued, in color, a compact summary of uses, indicating eight nozzle types and 69 sizes. Its convertibility into a cutting torch is stressed. Halftones and sketches illuminate the text.

In effect, the presentation is a preview of the Victor welding catalog.

American Iron & Machine Polish Rod Stuffing Box

The American Iron and Machine Works Co. of Oklahoma City and Houston, announces a new improved and simplified polish rod stuffing box. Major improvement, it is claimed, is the two-piece construction of this box.



The top part—the oil reservoir—can be easily detached and lifted from the lower section, which houses the polish rod rubbers. By lifting the top section of the box, old polish rod rubbers can be removed easily and quickly, thus making the installation of new rubbers a simple matter; this new construction also results in a considerable saving of time.

American polish rod rubbers are constructed with a special lead insert, designed to eliminate the pitting and scoring of polish rods. Even where the polish rod is already in pitted or scored condition, use of the new American polish stuffing box, it is claimed, will restore the rod to its original smoothness.

The American stuffing box is manufactured in the wobbler type, for straight lift purposes.

Hot Gas Drives New Turbine Engines

The gas turbine, newest source of cheap, compact power, is being used to compress air in catalytic refining processes. It operates on hot gas from burning low-cost fuel oil, resembling the steam turbine except that hot gas does the work of making power instead of super-heated steam. The operating cycle is the same as that of the diesel engine.

A complete power plant in one unit, its applications are many and varied. Biggest field for the gas turbine today is in generating electricity. It also is finding wide use in pressuring blast furnaces, a development under way for cheaper and more efficient smelting of iron ore.

A gas turbine locomotive, using oil for fuel, is being built in Switzerland.

Scientific and technical exhibits demonstrating new developments of interest to all members of the oil industry will be housed in the Hall of Science (above) on the grounds of the International Petroleum Exposition. Steps are being taken to obtain a portion of the San Francisco World's Fair petroleum exhibits, and the entire exhibit is under the direction of the internationally-known scientist, Dr. Gustav Egloff, director of research, Universal Oil Products Co., Chicago. May 18 to 25 is the date set for the Tulsa oil show.

Muller Bros. Score With "Station of the Stars"

From a modest beginning in 1929, when they first identified themselves as Associated dealers in Hollywood, the growth of Muller Bros. has been the envy of all who have observed their expansion.

During the 14 years that they have served Hollywood motorists with products of Tide Water Associated Oil Company, Muller Bros have frequently enlarged and expanded their facilities. The latest of these sensational expansion steps was completed only a short time ago. Discarding pump equipment, tearing down the station canopy and installing the latest in Zeon lighting, Muller Bros. replaced everything with the most modern equipment. With recent improvements, Muller Bros. has an investment in land and improvements of approximately $400,000 —"The Station of the Stars".

As motorists today swing out of the steadily flowing stream of traffic along Sunset Boulevard in Hollywood to head their cars into Muller Bros. station, they find six driveways easy of access.

Setting the pump islands at right angles to the street now enables drivers to approach with far greater safety. A crew of eleven men handles the assignment of dispensing Associated Aviation Ethyl and Flying "A" gasolines through the battery of nine modern computer pumps. Pumping 100,000 gallons of gasoline per month is a tremendous task, yet easily accomplished with such modern facilities as this station offers.

Engineer Makes Radio Address

Victor E. Poe, Los Angeles petroleum engineer, recently made a very interesting talk over Radio KGER on two interesting phases of the oil industry.

Mr. Poe's first point was the tremendous tax burden imposed upon petroleum which he stated was more than three times the net earnings of all the oil companies. In passing, he condemned the present tendency of political groups to misrepresent the adequacy of crude reserves and their over-emphasis of wastage which is now at its lowest point.

A second and very interesting portion of Mr. Poe's talk was devoted to the European petroleum situation in relation to the war. Being a native of Russia and having served as a cavalry officer in the White Army during the World War, Mr. Poe spoke with an unusual understanding of the problems involved in supplying fuel for the war machines of Germany.

A.I.M.E. To Hear Colombia Geologist Talk

Dr. Thomas Clements, head of the Geological Department at the University of Southern California, will speak at the Annual Dinner Meeting of the American Institute of Mining and Metallurgical Engineers on Thursday Evening, December 7th at the Los Angeles Athletic Club.

Dr. Clements, recently returned from a geological reconnaissance in Colombia, South America, will outline the comparative geology of the East—West side of the Cordillera, stressing the Miocene and Eocene.

R. G. Taylor, Jr., Named Chief Engineer by Guiberson

The Guiberson Corp., of Dallas, Texas, has announced the appointment of R. G. Taylor, Jr. as chief engineer, succeeding Albert Pranger who, as was recently announced, has taken up special field research work in finding and developing new products, for the corporation.

Mr. Taylor began his technical career as a mechanic for Douglas Aircraft, at Santa Monica, Calif., in 1929. Two years later he took up the study of mechanical engineering at the University of Southern California. After completing his studies he served successively with Hogan Petroleum Co., at Bakersfield, Calif., as roughneck, with Bell & Loffland, drilling contractors, and with the W. R. Guiberson Co., of Los Angeles, as field sales representative and engineer. On Jan. 1, 1939, he was transferred to the Guiberson headquarters offices at Dallas, where he has served in the capacity of gas-lift engineer in connection with the sales of Guiberson Gas-Lift Flow Valves and related equipment until recently taking up the duties of Chief Engineer.

New Field Postings

Effective Oct. 1, 1939 at 7:00 a.m. the following are the prices of Standard Oil Company of California for its current purchases of crude oil at the well in the Cole's Levee and Richfield Western fields:

27 to 27.9 Gravity	$1.00
28 Gravity	1.03
29 Gravity	1.06
30 Gravity	1.09
31 Gravity	1.13
32 Gravity	1.16
33 Gravity	1.19
34 Gravity	1.22
35 Gravity	1.26
36 Gravity	1.29
37 Gravity	1.32
38 Gravity	1.35
39 Gravity	1.39
40 Gravity	1.42
41 Gravity	1.45
42 Gravity	1.48
43 Gravity	1.51
44 Gravity	1.55
45 Gravity	1.58
46 Gravity and above	1.61

No changes in other fields.

New Book in The A.P.I. Library

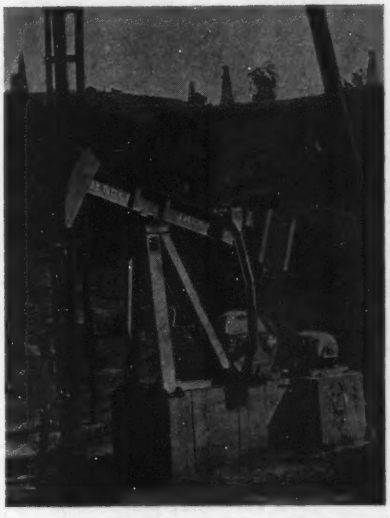
Finding and Producing Oil; 338 pages; cloth; charts, tables, and halftones; prepared and published by American Petroleum Institute, Division of Production, 508 Gulf States Bldg., Dallas, Tex.; $3.00.

First edition of a manual of information on the business of finding and producing oil, designed to concentrate in convenient form important reference material relating directly to the discovery and production of petroleum and natural gas. Outlines the present state of the art, indicates various services and facilities available to those engaged in the business. Includes a digest of laws pertaining to production, and a list of persons, firms, or corporations directly or indirectly active in this field.

Many authors, each experienced in special fields of productive effort, have contributed to make the volume a reasonably complete and thoroughly helpful reference work. Subjects covered include geological and geophysical methods of exploration; methods of drilling; sampling, coring, and bore-hold surveying; methods of producing; measuring, sampling, and testing; cooperative activities; vocational and scholastic training; research laws, and lists of trade associations, professional societies, producers, drilling contractors, and manufacturers, supply houses, and servicing agencies.

Above and at right is a new type of low cost individually powered pumping unit, moving 70 barrels daily fluid with one and a half horsepower electric application. This is one of the approximately 150 pumpers in the old Whittier Field in Los Angeles County, which was discovered in 1912. Installed in the rugged terrain surrounding the center of the field for Francis Savage, this 4-D Jensen Bros. Cable Head Pumping unit affords economy of operation and moves fluid commensurate with demands of the field at a total installation cost of $375.

With a small applied power factor, modest installation costs and efficiently designed to run long periods without human supervision, this unit affords maximum service for operators of pumping wells.



A crystalline compound is said to make fabrics flame-proof, protecting rugs and upholstery against cigarette burns.

Great Britain is rationing motor fuel on a horsepower basis as a wartime precaution. Owners of 20 horsepower cars are allowed ten gallons a month.

Tank cars of 8,000-gallon capacity are being fabricated by the fusion-welding process for experimental service.

Business and Professional Directory

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MAPS

Large maps of Los Angeles Basin oil fields and map showing all California oil fields. Price $15.00 each on paper and $20 each on cloth. Individual state oil and gas maps of Mid-Continent and Rocky Mountain regions. Maps show geological cross sections at base. These maps indicate wells drilling, wells producing and abandoned, with depths.
All maps revised up to date of purchase.
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Oil Men's Calendar

C.N.G.A. Meeting First Thurs. Each Month.

December

14-15—Petroleum Electric Power Association, Texas State Hotel, Houston, Texas.

1940—January

15-19—Society of Automotive Engineers, Annual Meeting and Engineering Display, Book-Cadillac Hotel, Detroit, Mich.

February

12-15—American Institute of Mining & Metallurgical Engineers, New York.

April

8-12—American Chemical Society, Cincinnati, Ohio.

10-12—American Association of Petroleum Geologists, Chicago, Ill.

11-12—American Petroleum Institute, Eastern District, Division of Production, Columbus, Ohio.

18-19—National Petroleum Assn., 37th Semi-Annual Meeting, Cleveland Hotel, Cleveland, Ohio.

May

1-3—Petroleum Industry Electrical Assn., Dallas, Texas.

15-17—Natural Gasoline Association of America, Hotel Tulsa, Tulsa, Okla.

18-25—Int. Pet. Exposition, Tulsa.

Electron Bombardment In Scientific Cracking

Scientists who have been chasing molecules for years now are on the trail of petroleum. Experimental "bombardment" of propane, propylene, and allene has shown that the molecules in these petroleum hydrocarbons can be broken down into smaller ones by electron bombardment, just as they are broken down by heat and pressure in refinery cracking processes.

California Crude Oil Production

Two Weeks Ended November 11, 1939

	November Daily uota	Average Daily Production	Excess
San Joaquin Valley			
Belridge—North	12,993	12,269	*724
Belridge—South	2,072	1,159	*913
Buena Vista	16,777	15,522	*1,255
Canal	5,709	5,494	*215
Coalinga-East (Eocene)	9,450	10,668	1,218
Coalinga—East-West	15,720	12,069	*3,651
Edison	2,277	2,375	98
Elk Hills	7,712	9,942	2,230
Fruitvale	6,108	6,408	300
Greeley	2,793	2,417	*376
Kern Front	7,307	6,482	*825
Kern River	6,773	4,097	*2,676
Kettleman No. Dome	34,485	51,558	17,073
Lost Hills	4,006	3,540	*466
McKittrick	3,732	3,393	*339
Midway	37,538	29,305	*8,233
Mount Poso	10,139	10,821	682
Mountain View	9,573	9,685	112
Rio Bravo	7,140	7,315	175
Round Mt. and Coffee Canyon	7,916	8,207	291
Ten Section	8,491	8,479	*12
Wasco	1,265	1,409	144
Other Fields	5,554	5,560	6
TOTAL	225,530	228,174	2,644
Coastal Counties			
Elwood	3,756	4,075	319
Rincon	2,465	3,629	1,164
Santa Maria	6,414	3,980	*2,434
Gato Ridge	2,583	4,263	1,680
Santa Maria Valley	18,883	10,287	*8,596
Santa Paula-Newhall	5,844	6,365	521
Ventura Avenue	30,040	35,235	5,195
Other Fields	5,304	5,952	648
TOTAL	75,289	73,786	*1,503
Los Angeles Basin			
Alamitos-Seal Beach	6,992	7,117	125
Brea-Olinda	8,093	5,723	*2,370
Coyote—East	3,032	2,745	*287
Coyote—West	9,924	10,350	426
Domingues	16,766	18,112	1,346
El Segundo	2,956	1,973	*983
Huntington Beach—New and Old	23,228	28,086	4,858
Inglewood	13,075	12,885	*190
Long Beach	40,561	45,136	4,575
Montebello	5,831	5,824	*7
Montebello-West End	20,688	20,938	250
Playa del Rey	4,296	4,540	244
Richfield	7,396	8,065	669
Rosecrans-Athens	8,482	10,879	2,397
Santa Fe Springs	24,686	27,011	2,325
Torrance	5,436	5,322	*114
Torrance "34" and "D & B"	8,079	9,294	1,215
Wilmington	81,080	85,839	4,759
Other Fields	3,749	4,453	704
TOTAL	294,350	314,292	19,942
STATE TOTAL	595,169	616,252	21,083

*—Shortage.